NPS 68-85-003

NAVAL POSTGRADUATE SCHOOL

Monterey, California

HYDROGRAPHIC DATA FROM THE OPTOMA PROGRAM

OPTOMA5
12 JUNE - 20 JULY 1983

by

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January 1985

Prepared for:
Office of Naval Research
Environmental Sciences Directorate (Code 420)
Arlington, VA 22217

NAVAL POSTGRADUATE SCHOOL

Monterey, California 93943

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This report is for the research project "Ocean Prediction Through Observations, Modeling and Analysis" sponsored by the Physical Oceanography Program of the Office of Naval Research under Program Element 61153N.

This report was Prepared by:

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NPS 68-85-003

2. GOVT ACCESSION NO.:

3. RECIPIENT'S CATALOG NUMBER:

4. TITLE (and Subtitle): HYDROGRAPHIC DATA FROM THE OPTOMA PROGRAM OPTOMA5, LEGS D, AI, AII, & AIII, 12 June - 20 July 1983

5. TYPE OF REPORT & PERIOD COVERED: Report for October 1982 to January 1985

6. PERFORMING ORG. REPORT NUMBER:

7. AUTHOR(s): Paul A. Wittmann, Michele M. Rienecker, Edward A. Kelley, Christopher N. K. Mooers

8. CONTRACT OR GRANT NUMBER(s):

9. PERFORMING ORGANIZATION NAME AND ADDRESS: Naval Postgraduate School, Monterey, CA 93943

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 61153N, N0001484WR24051

11. CONTROLLING OFFICE NAME AND ADDRESS: Office of Naval Research (Code 420), Arlington, VA 22217

12. REPORT DATE: January 1985

13. NUMBER OF PAGES: (99)

14. MONITORING AGENCY NAME & ADDRESS (If different from Controlling Office):

15. SECURITY CLASS. (of this report): Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT (of this Report): Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report):

18. SUPPLEMENTARY NOTES:

19. KEY WORDS (Continue on reverse side if necessary and identify by block number):

California Current System
Physical Oceanography
Dynamic Oceanography

20. ABSTRACT (Continue on reverse side if necessary and identify by block number):

The cruise OPTOMA5 was undertaken in June and July 1983 to sample two subdomains of the California Current System. This report presents the hydrographic data, acquired by XBT and CTD casts, from the cruise.

Hydrographic Data from the **OPTOMA** *Program: OPTOMA5*

12 June - 20 July, 1983

by

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Michele M. Rienecker
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The **OPTOMA** Program is a joint program of

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Naval Postgraduate School
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Harvard University
Cambridge, MA 02138.

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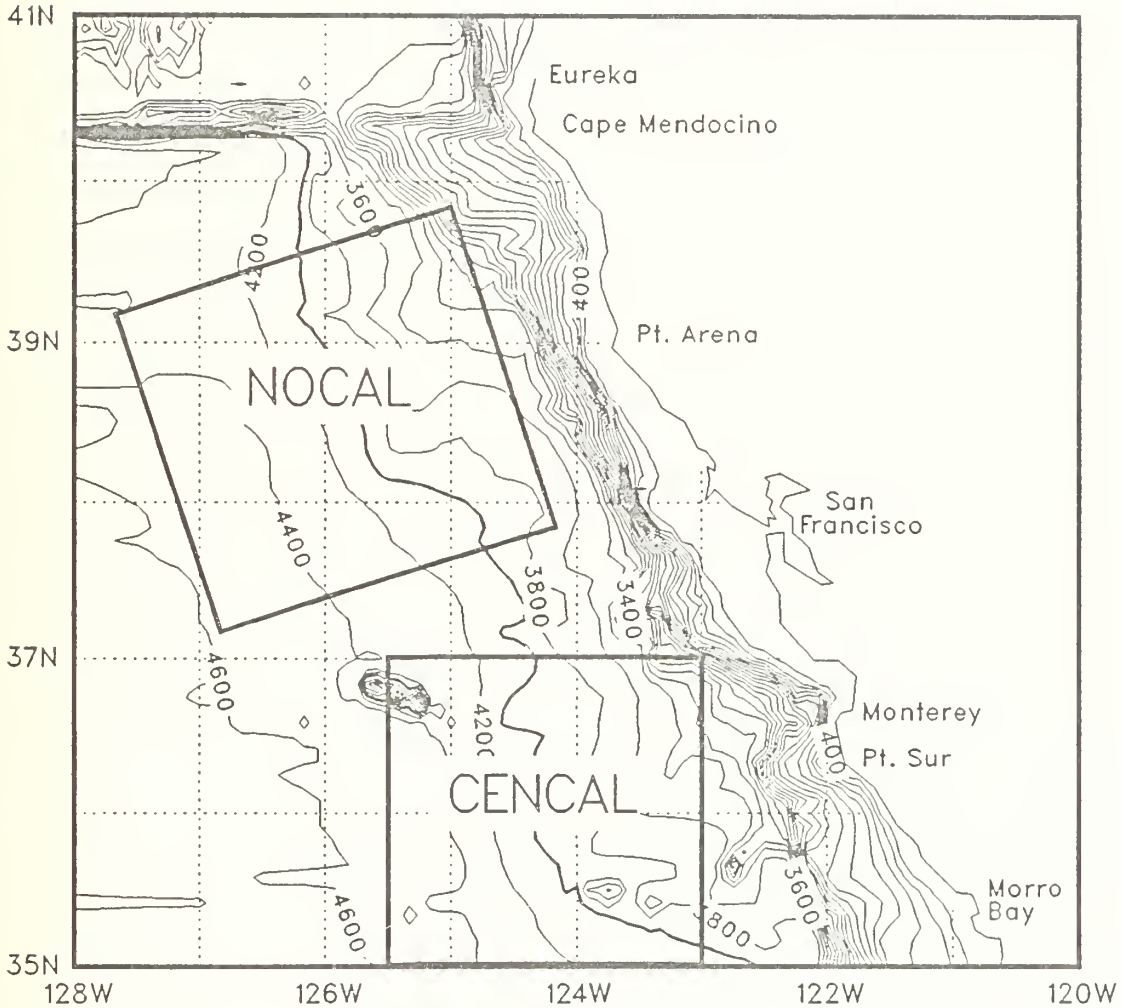

Figure 1: The NOCAL and CENCAL subdomains of the OPTOMA Program. Isobaths are shown in meters.

INTRODUCTION

The OPTOMA (Ocean Prediction Through Observations, Modeling and Analysis) Program, a joint NPS/Harvard program sponsored by ONR, seeks to understand the mesoscale (fronts, eddies, and jets) variability and dynamics of the California Current System and to determine the scientific limits to practical mesoscale ocean forecasting. To help carry out the aims of this project, a series of cruises has been planned in two subdomains, NOCAL and CENCAL, shown in Figure 1.

The four cruises comprising OPTOMA 5 were undertaken, during June and July, 1983, in the USNS De Steiguer (Leg D) and the R/V Acania (Legs AI, AII, AIII). Hydrographic data were acquired off the coast of California in an area which covered and extended the NOCAL region.

Leg D was carried out from 12 to 20 June 1983 and sampled an area roughly 300 km from the coast by 600 km alongshore from Cape Mendocino to Pt Sur, as shown in Figure 2. Hydrographic stations were occupied approximately every 20 km along the track. Leg AI was carried out from 15 to 22 June, Leg AII from 29 June to 4 July and Leg AIII from 13 to 20 July. These three legs sampled an area approximately 120 km square, centered about 190 km off the coast between Pt. Reyes and Pt. Arena, with additional transects to and from the domain, as shown in Figures 13, 24, and 30, respectively. Transect extremes are identified by letter in these figures to aid in cross-referencing the data presented in subsequent figures. On each of these cruises, hydrographic stations were occupied at approximately 15 km along the track.

DATA ACQUISITION

Data acquired during OPTOMA5 Leg D include XBT and CTD profiles. Bucket surface temperature and water samples for salinity were taken at every CTD station. These surface values were used for calibration purposes as well as contributions to the data base.

Data acquired during Legs AI and AIII include XBT and CTD profiles. Data acquired during Leg AII include XBT profiles. Legs AI, AII, and AIII acquired continuous 2 m thermosalinograph measurements. A bucket surface temperature and a water sample for salinity were taken at every CTD station. These surface values and those at 2 m were used for calibration purposes as well as contributions to the data base. Continuous meteorological data such as atmospheric pressure at a height of 2 m and wind speed and direction at a height of 20 m and intermittent acoustic Doppler velocity data were also recorded. The XBT, CTD and continuous "underway" data were digitized using an HP 5328 frequency counter and a 40 channel digital voltmeter. The continuous data were averaged over two-minute intervals. All data were recorded, using an HP 9835 computer, on data cassettes and transferred ashore to the IBM 3033 mainframe computer for editing and processing.

Station positions were determined by Loran C fixes and are claimed to be accurate to within about 0.1 km. Table 1 on page 5 summarizes the various sensors available on the R/V ACANIA and their accuracy. A Neil Brown CTD and Sippican XBT's were also used on the USNS DE STEIGUER; their accuracies are the same as stated in Table 1. The bottle surface salinity samples were determined by a Guildline Model 8400 "Autosal" salinometer with an accuracy of $\pm$0.003 ppt (samples from Leg D were determined onboard; samples from Legs AI and AIII were determined ashore).

DATA PROCESSING

Data processing, such as estimating depth profiles for the XBT temperature profiles based on the XBT's descent speed, and conversion of CTD conductivity to salinity using the algorithm given in Lewis and Perkin (1981), was carried out on the IBM 3033 at the Naval Postgraduate School, except for Leg D. The data for Leg D were digitized from analog traces by the National Oceanographic Data Center through the NOAA/NESDIS Liason Office in La Jolla, CA and sent on tape to the Naval Postgraduate School for editing and analysis. The data were then edited by removing obvious salinity spikes and eliminating cast failures that were not identified during the cruise. Approximately 97%, 100%, 100%, and 98% of casts were retained in the data set of Legs D, AI, AII, and AIII, respectively. The surface salinities from the CTD casts for Leg D were too high on average by 0.07 ppt and too low for Legs AI and AIII by 0.04 and 0.02 ppt, respectively. The surface salinities were adjusted accordingly; however a comparison showed the mean T-S curve from Leg D to be offset by roughly 0.10 ppt from the mean T-S curves of Legs AI and AIII which were in close agreement with each other and with T-S curves from previous cruises in the same region. A possible explanation for the T-S curve offset from Leg D is that the Leg D salinity samples were determined aboard the USNS DE STEIGUER and an error may have been introduced due to a problem with calibration of the onboard AUTOSAL. In any event, the final Leg D salinities that appear in this report are the unadjusted salinities determined from the CTD data. The CTD data were interpolated to 5 m intervals and then up and down casts were averaged.

The data have been transferred on digital tape to the National Oceanographic Data Center in Washington, DC.

DATA PRESENTATION

The cruise track, station locations (with XBT's and CTD's identified) and station numbers are shown in the first three figures of each of the next four sections, which present the data from Legs D, AI, AII, and AIII, respectively. These figures are followed by a listing of the stations, with their coordinates, the date and time at which the station was occupied, and the surface information obtained at the station.

Vertical profiles of temperature from the XBT casts are shown in staggered fashion. The location of these profiles may be found by reference to the various maps of the cruise track. Transect extremes are identified as nearly as possible. The first profile on each plot is shown with its temperature unchanged; to each subsequent profile an appropriate multiple of 5C has been added. Vertical profiles from the CTD's follow (except Leg AII). Profiles of temperature are staggered by 5C and those of salinity by 4 ppt.

Isotherms for each transect are shown in the next pages, followed by isopleths of temperature, salinity and sigma-t from the CTD's(Leg D only). Based on instrument accuracy and the vertical temperature gradient, it is estimated that depths of isotherms in the main thermocline are uncertain to $\pm$20m. The tick marks identify station positions and, again, the transect extremes are shown on these plots.

Each section includes mean profiles of temperature from the XBT's. In addition, for all legs except AII, mean profiles of temperature, salinity and sigma-t from the CTD's are given as well as a scatter diagram of the T-S pairs and the mean S(T) curve, with the $\pm$ standard deviation envelope, and the data presentation concludes with a plot of the mean N^2 (Brunt-Vaisala frequency squared) profile with $\pm$ the standard deviation. On the sigma-t and N^2 plots, the appropiate profiles derived from the mean temperature and mean salinity profiles are also shown.

Table 1: Scientific instruments aboard the R/V ACANIA

	Instrument	Variable	Sensor	Accuracy	Resolution
	Neil Brown CTD Mark IIIb	pressure	strain gage	1.6 db	0.025 db
		temperature	thermistor	0.005 C	0.0005 C
		conductivity	electrode cell	0.005 mmho	0.001 mmho
	Sippican BT	temperature	thermistor	0.2 C	
		depth	descent speed	greater of 4.6 m and 2% of depth	
*	Guildline Autosal	conductivity	electrode cell	0.003 ppt	0.0002 ppt
	Amatek straza ADVP	velocity profiles to 100m	4 beam sonar	3 cm/sec relative to ship speed	3 cm/sec
*	Rosemount Sensor	sea surface temperature	platinum thermometer	0.05 C	0.005 C
	Sea-Bird Sensors	temperature	thermistor	0.003 C	0.0005 C
		conductivity at 2 meters	electrode cell	0.003 mmho	0.0005 mmho
	Rosemount Sensor	air temperature	thermometer	0.01 C	
	Kavolico Barometer	atmospheric pressure	pressure transducer	1.5 mb	0.1 mb
*	1200 EPS Hygrometer	dew point	condensation temp. sensor	0.2 C	0.02 C
	Meteorology Res. Inc.	wind speed	anemometer	0.15 mph or 1%	
	Meteorology Res. Inc.	wind direction	vane	2.5 degrees	
	Internav LC408 LORAN C	position	two chain LORAN receiver	100 meters	10 meters
	Motorola Miniranger	position	microwave transponders	4 meters	2 meters

* Not operating on the OPTOMA5 cruise.

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SECTION 1

OPTOMA5 Leg D

12 - 20 June 1983

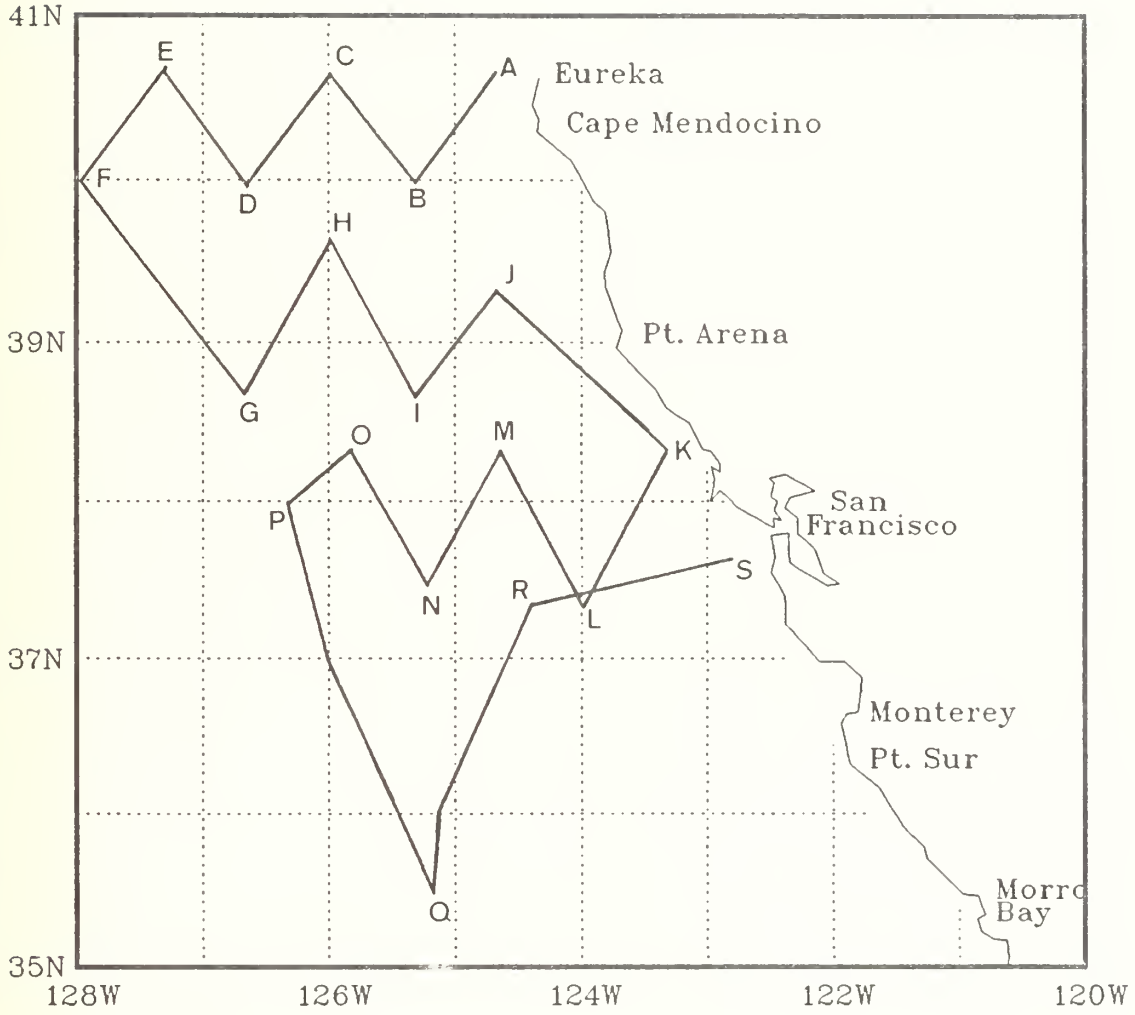


Figure 2: Cruise track for OPTOMA5, Leg D with transect extremes identified by letter.

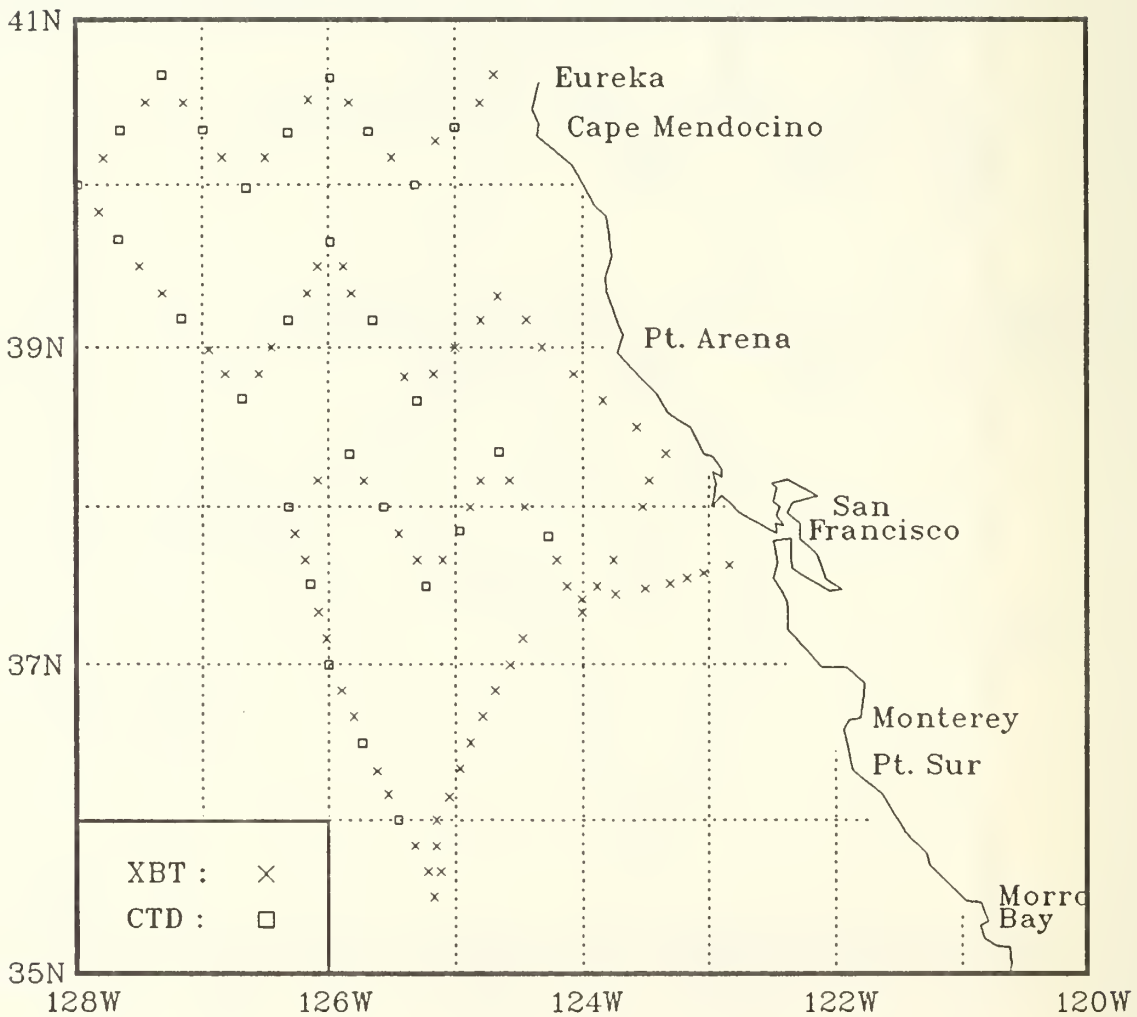


Figure 3: XBT and CTD locations for OPTOMA5, Leg D.

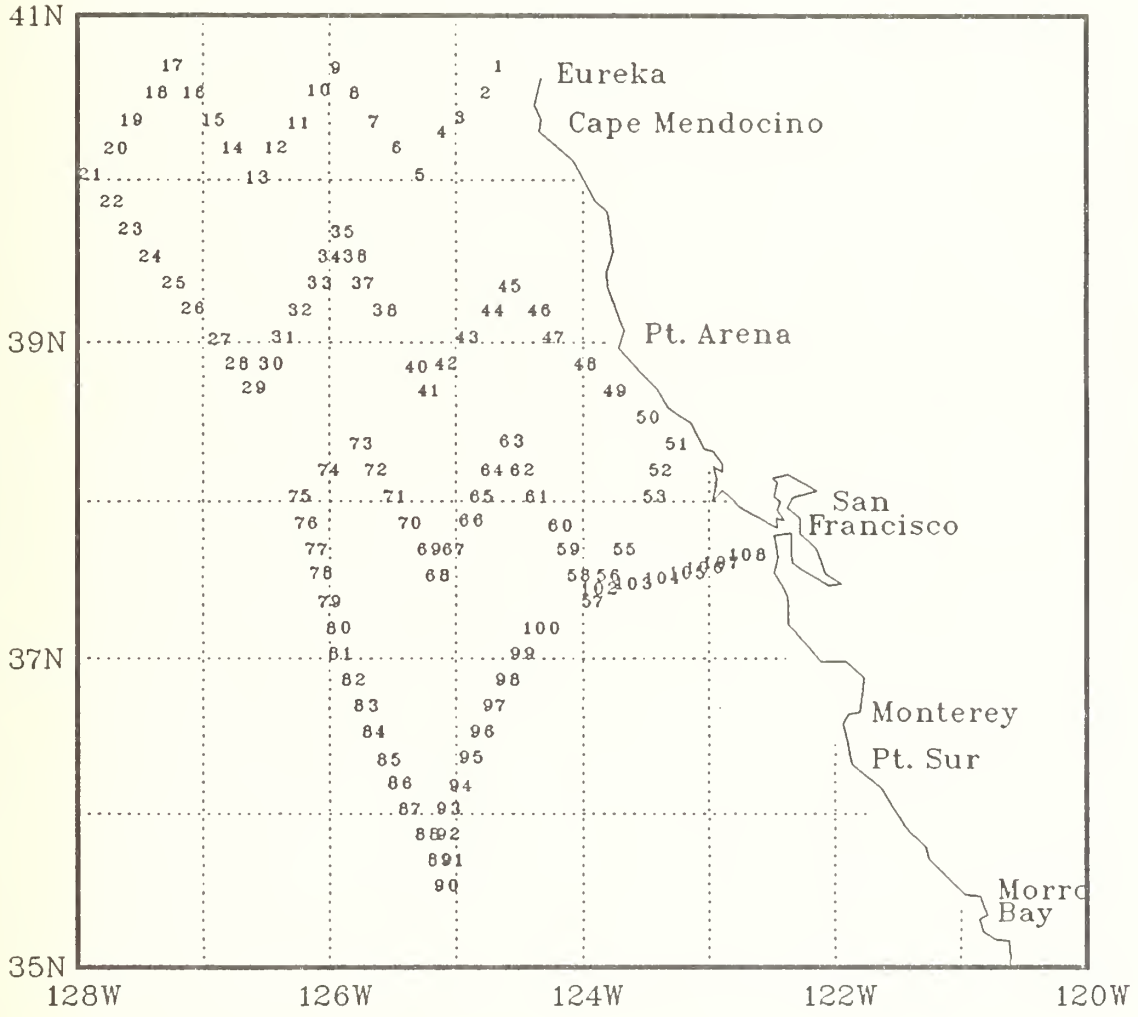


Figure 4: Station numbers for OPTOMA5, Leg D.

Table 2: Leg D Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
1	XBT	83164	507	40.40	124.41	13.5			
2	XBT	83164	607	40.30	124.48	12.3			
3	CTD	83164	744	40.21	125.00	11.7	32.98	11.8	33.06
4	XBT	83164	947	40.16	125.09	13.0			
5	CTD	83164	1101	40.00	125.19	13.6	32.60	13.8	32.43
6	XBT	83164	1320	40.10	125.30	14.0			
7	CTD	83164	1511	40.20	125.41	13.8	32.67	13.8	32.62
8	XBT	83164	1713	40.30	125.50	14.0			
9	CTD	83164	1907	40.39	125.59	13.7	32.51	14.0	32.15
10	XBT	83164	2110	40.31	126.10	14.0			
11	CTD	83164	2224	40.19	126.19	14.1	32.59	14.0	32.50
12	XBT	83165	26	40.10	126.30	15.1			
13	CTD	83165	150	39.59	126.39	14.2	32.53	14.3	32.42
14	XBT	83165	401	40.10	126.50	14.5			
15	CTD	83165	516	40.20	127.00	13.7	32.48	14.3	32.43
16	XBT	83165	724	40.30	127.09	14.5			
17	CTD	83165	852	40.40	127.19	14.1	32.45	14.4	32.33
18	XBT	83165	1053	40.30	127.27	15.5			
19	CTD	83165	1234	40.20	127.39	14.8	32.84	14.9	32.82
20	XBT	83165	1434	40.10	127.47	14.6			
21	CTD	83165	1608	40.00	127.59	14.5	32.85	14.5	32.79
22	XBT	83165	1805	39.50	127.49	14.9			
23	CTD	83165	1910	39.40	127.40	14.4	32.79	14.5	32.73
24	XBT	83165	2141	39.30	127.30	15.3			
25	XBT	83165	2313	39.20	127.19	15.0			
26	CTD	83166	45	39.11	127.10	14.4	32.85	14.5	32.71
27	XBT	83166	316	38.59	126.57	14.9			
28	XBT	83166	441	38.50	126.49	14.7			
29	CTD	83166	626	38.41	126.41	14.3	32.86	14.4	32.68
30	XBT	83166	935	38.50	126.33	14.8			
31	XBT	83166	1045	39.00	126.27	14.7			
32	CTD	83166	1213	39.10	126.19	14.4	32.87	14.5	32.88
33	XBT	83166	1421	39.20	126.10	14.8			
34	XBT	83166	1540	39.30	126.05	14.8			
35	CTD	83166	1653	39.39	125.59	14.1	32.53	14.7	32.47
36	XBT	83166	2000	39.30	125.53	14.9			
37	XBT	83166	2107	39.20	125.49	14.8			
38	CTD	83167	2219	39.10	125.39	14.2	32.69	14.4	32.68
40	XBT	83167	239	38.49	125.24	14.6			
41	CTD	83167	346	38.40	125.18	13.8	32.69	14.0	32.66
42	XBT	83167	625	38.50	125.10	14.3			
43	XBT	83167	813	39.00	125.00	14.2			
44	XBT	83167	1000	39.10	124.48	14.1			
45	XBT	83167	1135	39.19	124.40	14.1			
46	XBT	83167	1241	39.10	124.26	14.0			

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
47	XBT	83167	1353	39.00	124.19	14.0			
48	XBT	83167	1516	38.50	124.04	13.6			
49	XBT	83167	1631	38.40	123.50	12.9			
50	XBT	83167	1755	38.30	123.34	11.1			
51	XBT	83167	1915	38.20	123.20	11.2			
52	XBT	83167	2013	38.10	123.28	11.1			
53	XBT	83167	2115	38.00	123.31	11.9			
55	XBT	83168	47	37.40	123.45	14.9			
56	XBT	83168	203	37.30	123.53	14.9			
57	XBT	83168	358	37.20	124.00	14.0			
58	XBT	83168	527	37.30	124.07	14.6			
59	XBT	83168	641	37.40	124.12	12.7			
60	CTD	83168	811	37.49	124.16	12.0	32.96	12.2	32.96
61	XBT	83168	1008	38.00	124.27	12.7			
62	XBT	83168	1119	38.10	124.34	13.8			
63	CTD	83168	1224	38.21	124.39	13.5	32.62	13.8	32.58
64	XBT	83168	1557	38.10	124.48	12.9			
65	XBT	83168	1703	38.00	124.53	14.5			
66	CTD	83168	1804	37.51	124.58	12.5	33.00	12.7	32.94
67	XBT	83168	1947	37.40	125.06	14.7			
68	CTD	83168	2050	37.30	125.14	14.2	32.69	14.5	32.64
69	XBT	83169	15	37.40	125.18	14.7			
70	XBT	83169	146	37.50	125.27	14.4			
71	CTD	83169	304	38.00	125.34	13.9	32.81	14.1	32.75
72	XBT	83169	501	38.10	125.43	14.3			
73	CTD	83169	620	38.20	125.50	14.3	32.65	14.1	*
74	XBT	83169	1035	38.10	126.05	14.9			
75	CTD	83169	1202	38.00	126.19	14.4	32.69	14.5	*
76	XBT	83169	1400	37.50	126.16	14.7			
77	XBT	83169	1458	37.40	126.11	14.7			
78	CTD	83169	1603	37.31	126.09	14.7	32.80	14.6	*
79	XBT	83169	1910	37.20	126.05	15.6			
80	XBT	83169	2008	37.10	126.01	15.9			
81	CTD	83169	2108	37.00	126.00	15.2	33.08	15.4	*
82	XBT	83169	2255	36.50	125.54	15.9			
83	XBT	83169	2357	36.40	125.48	15.9			
84	CTD	83170	105	36.30	125.44	15.1	32.97	15.4	*
85	XBT	83170	414	36.19	125.37	15.6			
86	XBT	83170	511	36.10	125.32	16.1			
87	CTD	83170	612	36.00	125.27	15.5	33.15	15.6	*
88	XBT	83170	810	35.50	125.19	15.5			
89	XBT	83170	920	35.40	125.13	15.9			
90	XBT	83170	1052	35.30	125.10	15.9			
91	XBT	83170	1404	35.40	125.07	15.8			
92	XBT	83170	1734	35.50	125.09	15.8			

* Data not available

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
93	XBT	83170	2008	36.00	125.09	15.0			
94	XBT	83170	2227	36.09	125.03	14.8			
95	XBT	83171	56	36.20	124.58	14.9			
96	XBT	83171	245	36.30	124.53	14.8			
97	XBT	83171	437	36.40	124.47	14.8			
98	XBT	83171	710	36.50	124.41	14.5			
99	XBT	83171	946	37.00	124.34	14.4			
100	XBT	83171	1202	37.10	124.28	14.4			
102	XBT	83171	1604	37.25	124.00	13.9			
103	XBT	83171	1717	37.27	123.44	13.5			
104	XBT	83171	1829	37.29	123.30	11.7			
105	XBT	83171	1922	37.31	123.18	11.9			
106	XBT	83171	2003	37.33	123.10	11.6			
107	XBT	83171	2040	37.35	123.02	11.6			
108	XBT	83171	2200	37.38	122.50	11.8			

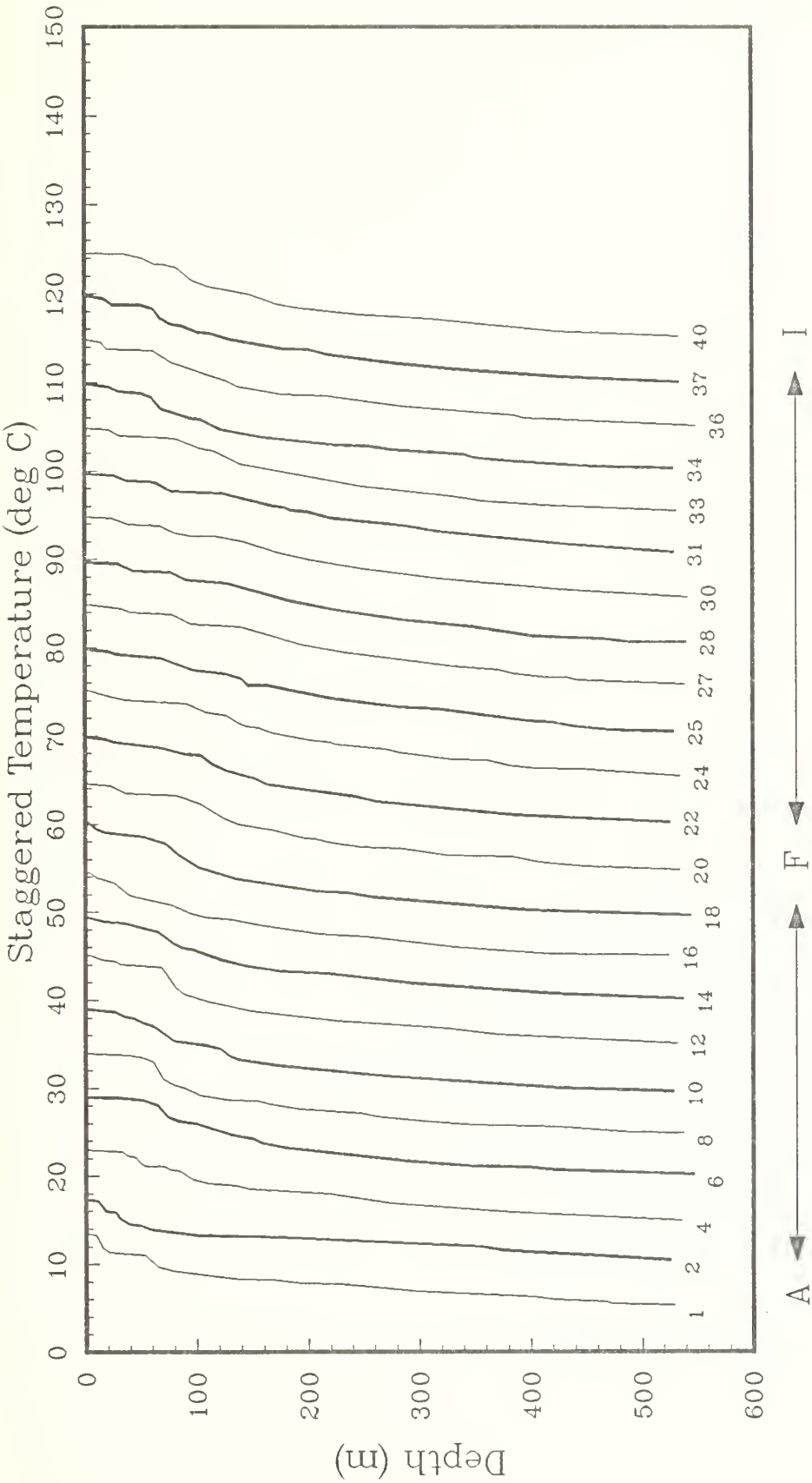
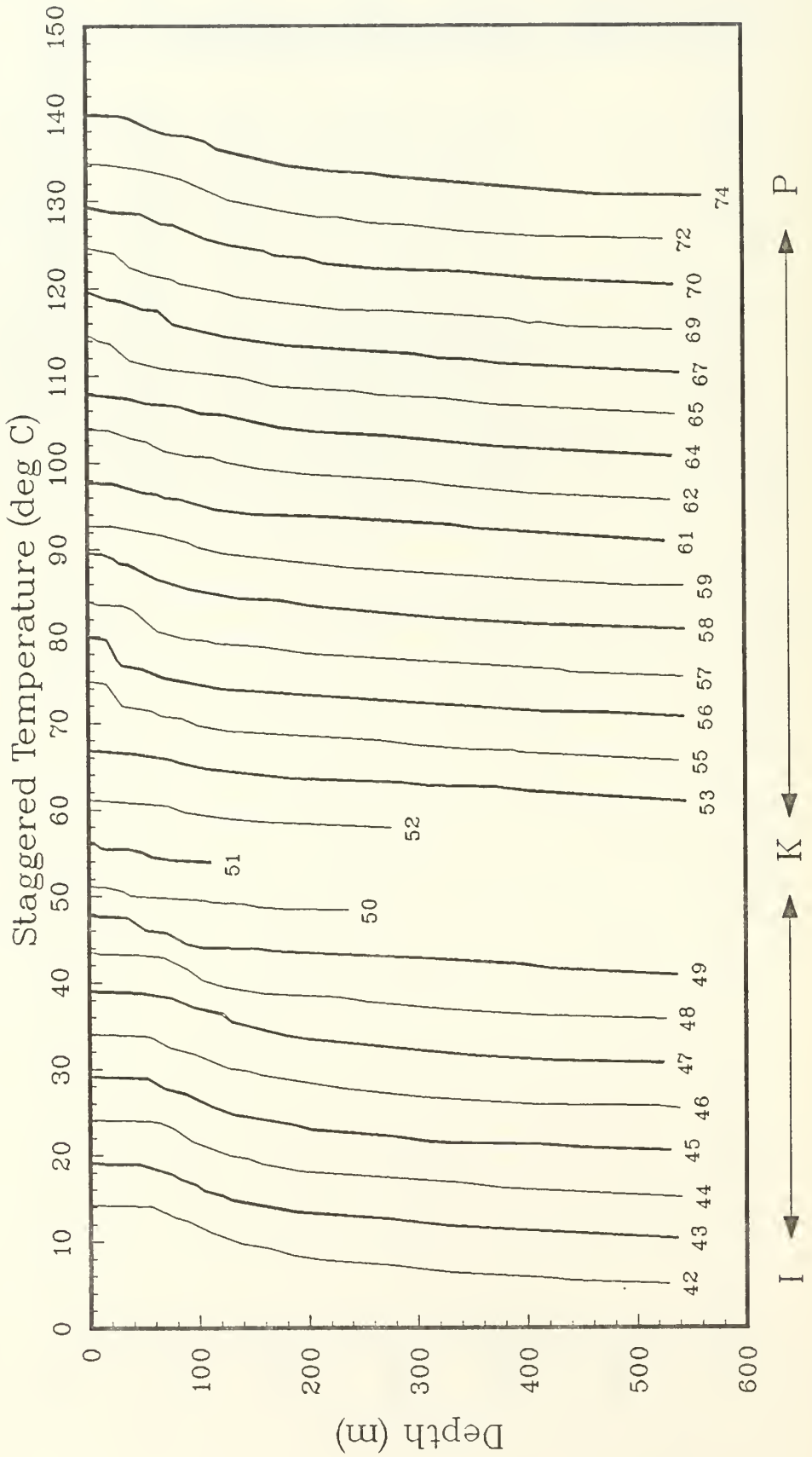


Figure 5(a): Staggered temperature profiles from the XBT's. Profiles are staggered by a multiple of 5C. (OPTOMA5, Leg D).


Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Depth (m)
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100
200
300
400
500
600
42
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44
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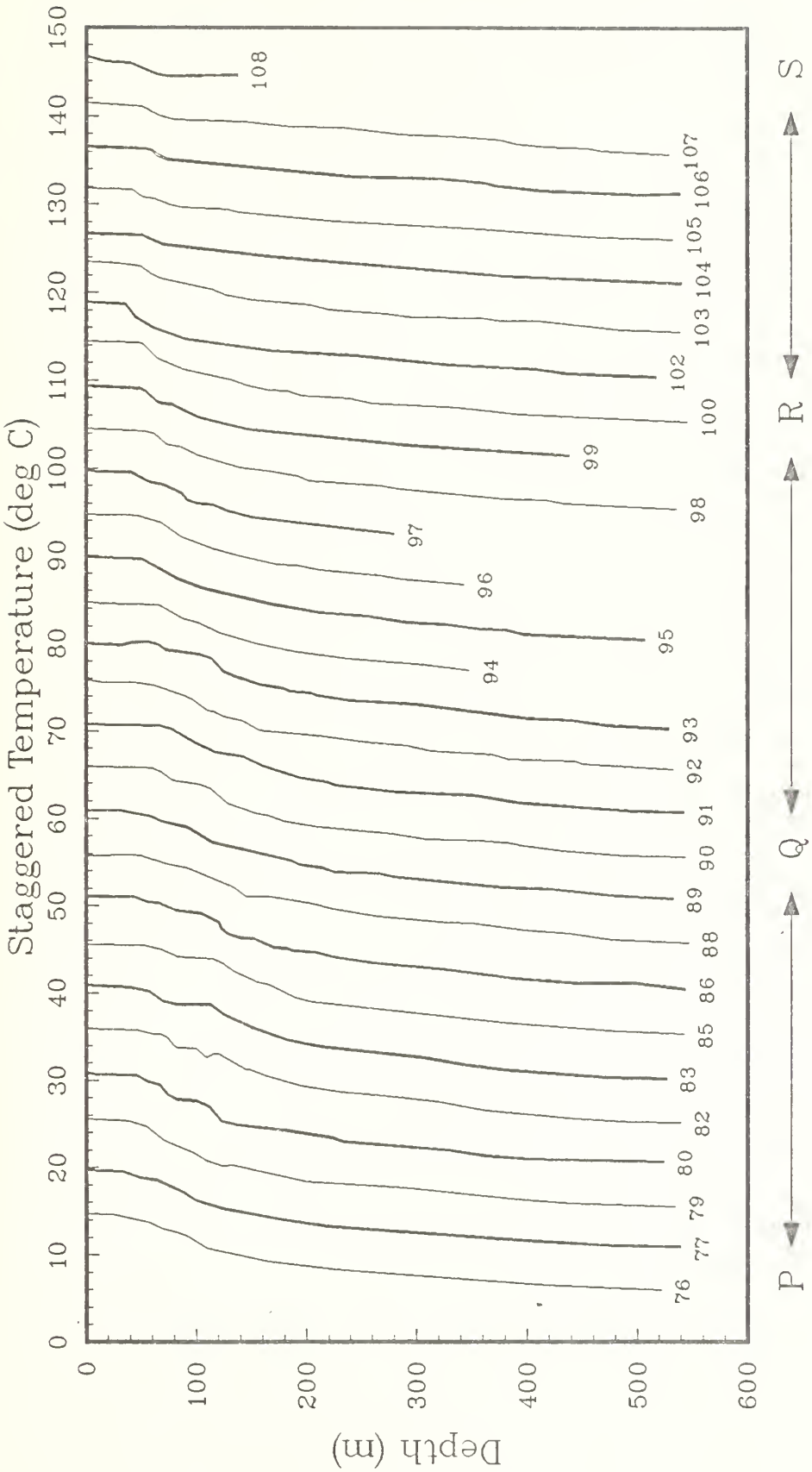
Figure 5(b)


Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Depth (m)
0
100
200
300
400
500
600
76
77
79
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S

Figure 5(c)

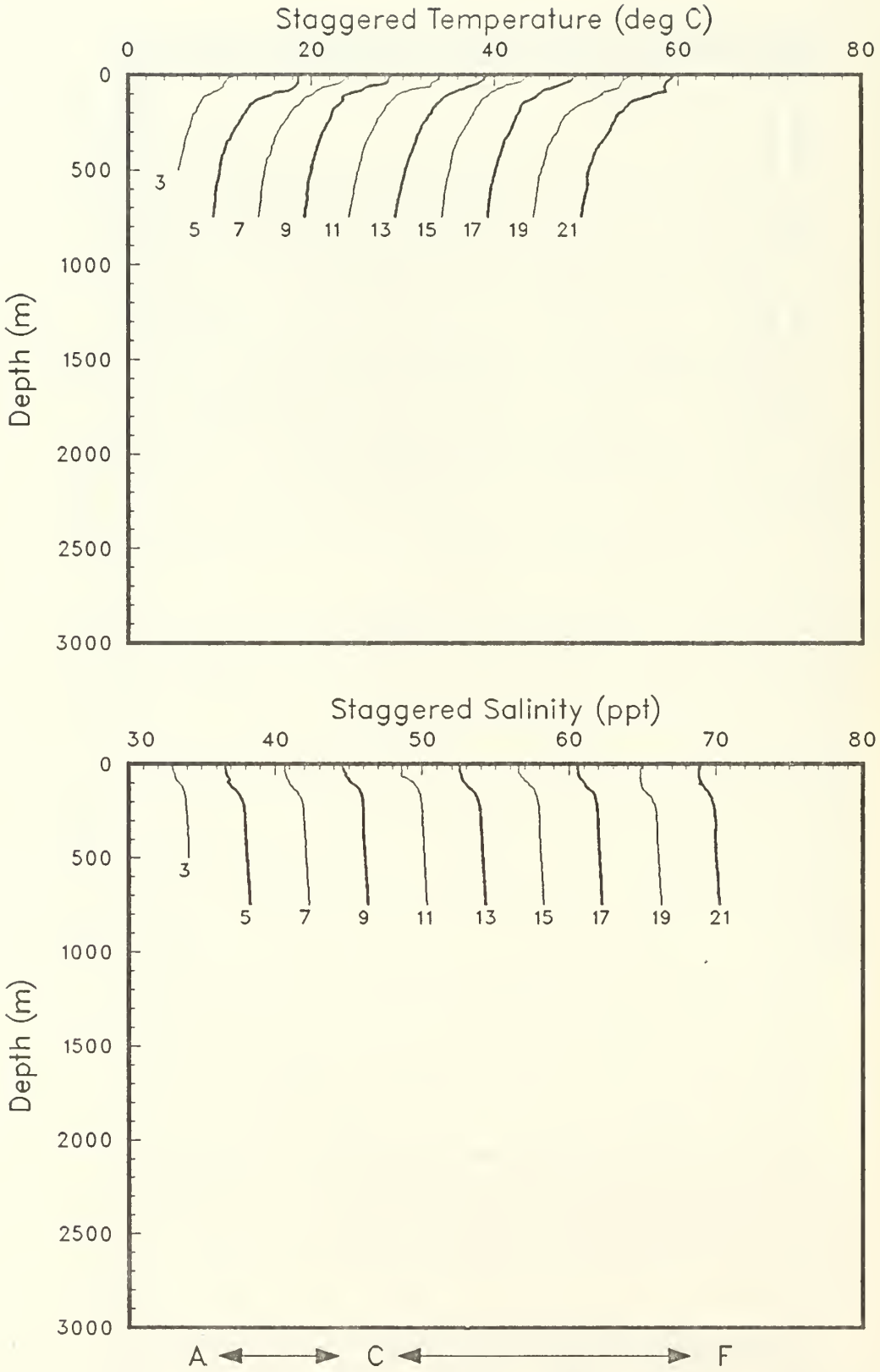

Figure 6(a): CTD temperature profiles, staggered by multiples of 5C, and salinity profiles, staggered by multiples of 4 ppt. (OPTOMA5, Leg D).

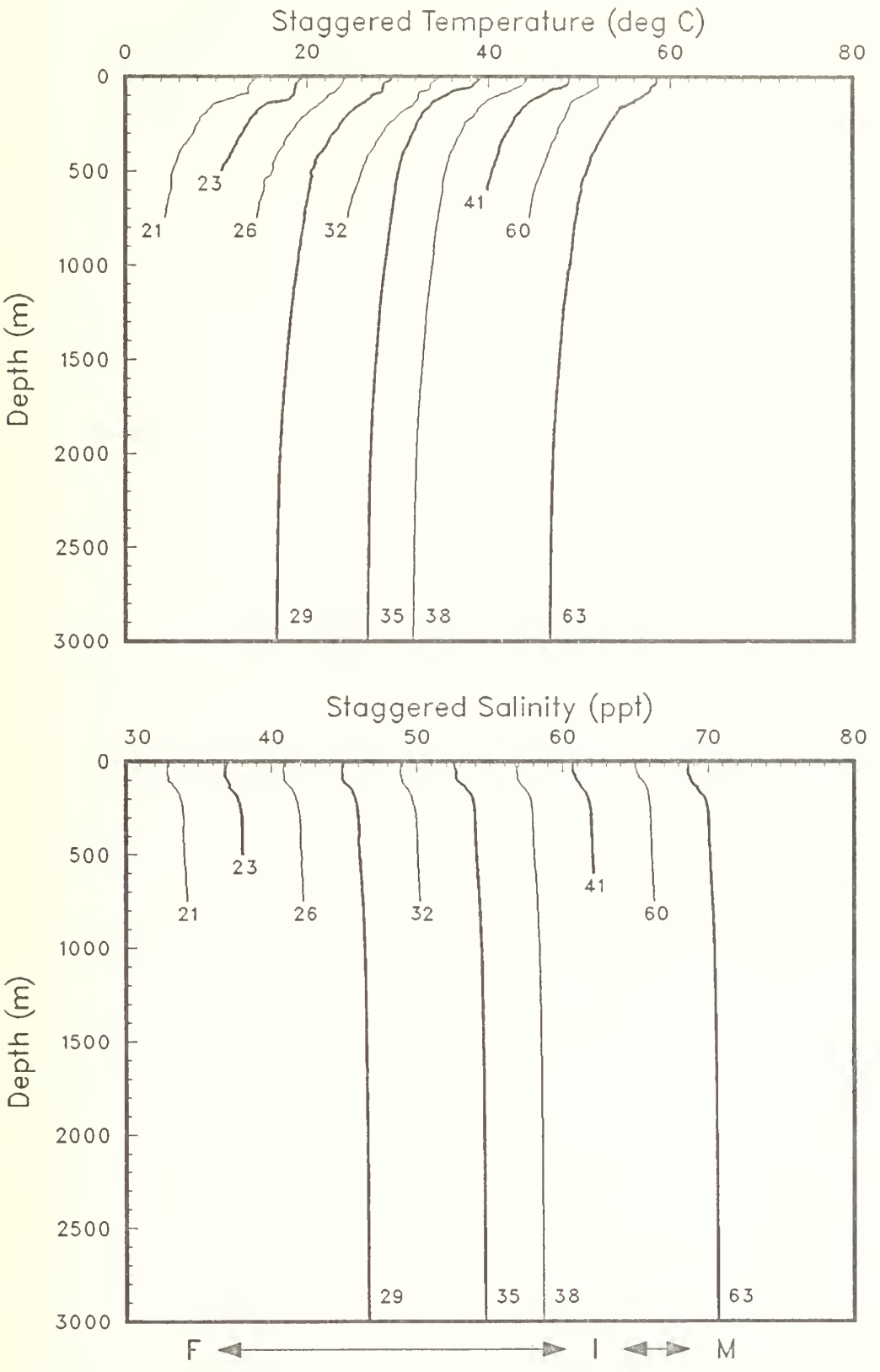
Staggered Temperature (deg C)
0
20
40
60
80
0
500
1000
1500
2000
2500
3000
Depth (m)
21
23
26
32
41
60
29
35
38
63
Staggered Salinity (ppt)
30
40
50
60
70
80
0
500
1000
1500
2000
2500
3000
Depth (m)
21
23
26
32
41
60
29
35
38
63
F
I
M

Figure 6(b)

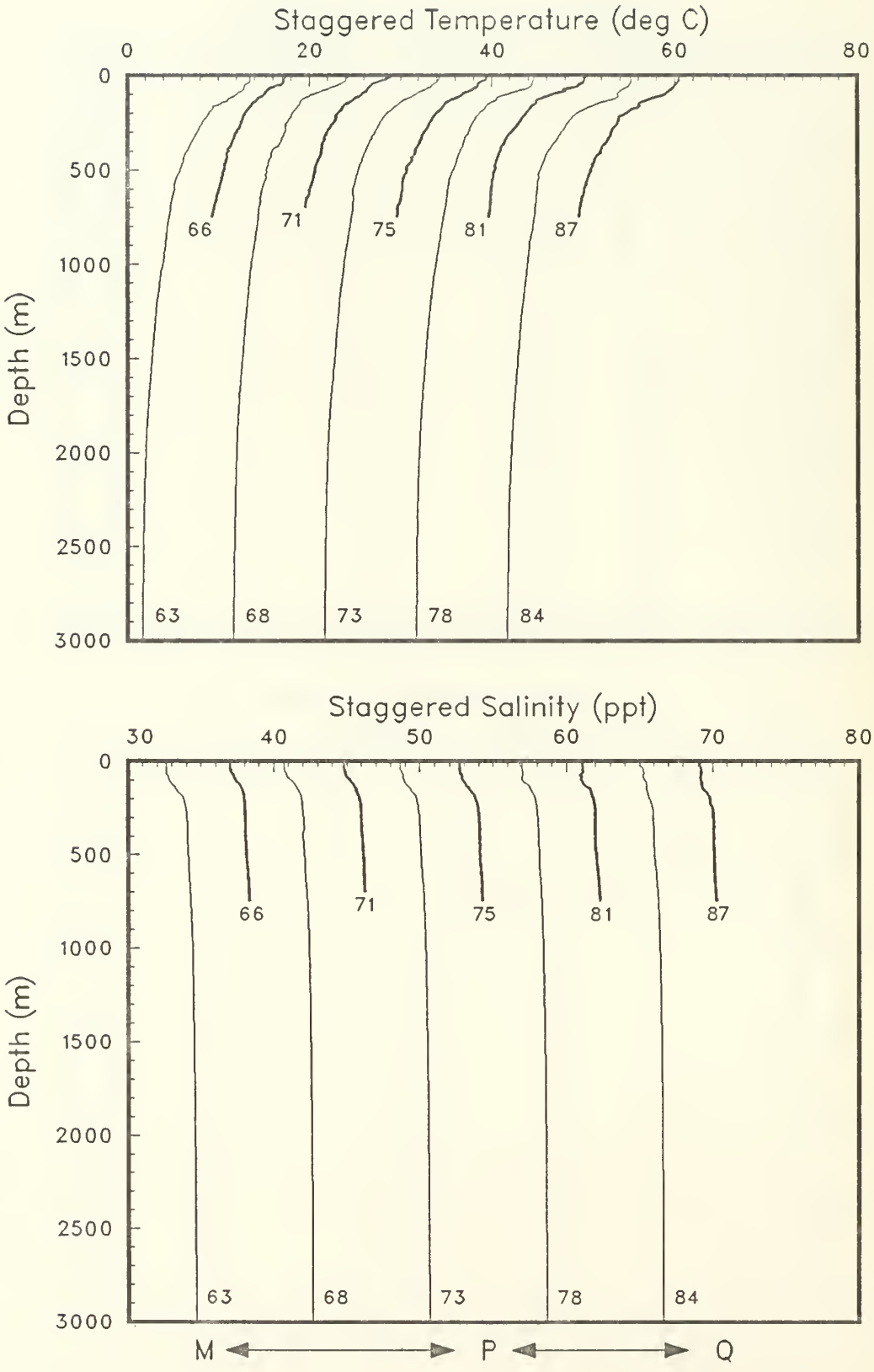
Staggered Temperature (deg C)
0
20
40
60
80
Depth (m)
0
500
1000
1500
2000
2500
3000
66
71
75
81
87
63
68
73
78
84
Staggered Salinity (ppt)
30
40
50
60
70
80
Depth (m)
0
500
1000
1500
2000
2500
3000
66
71
75
81
87
63
68
73
78
84
M
P
Q

Figure 6(c)

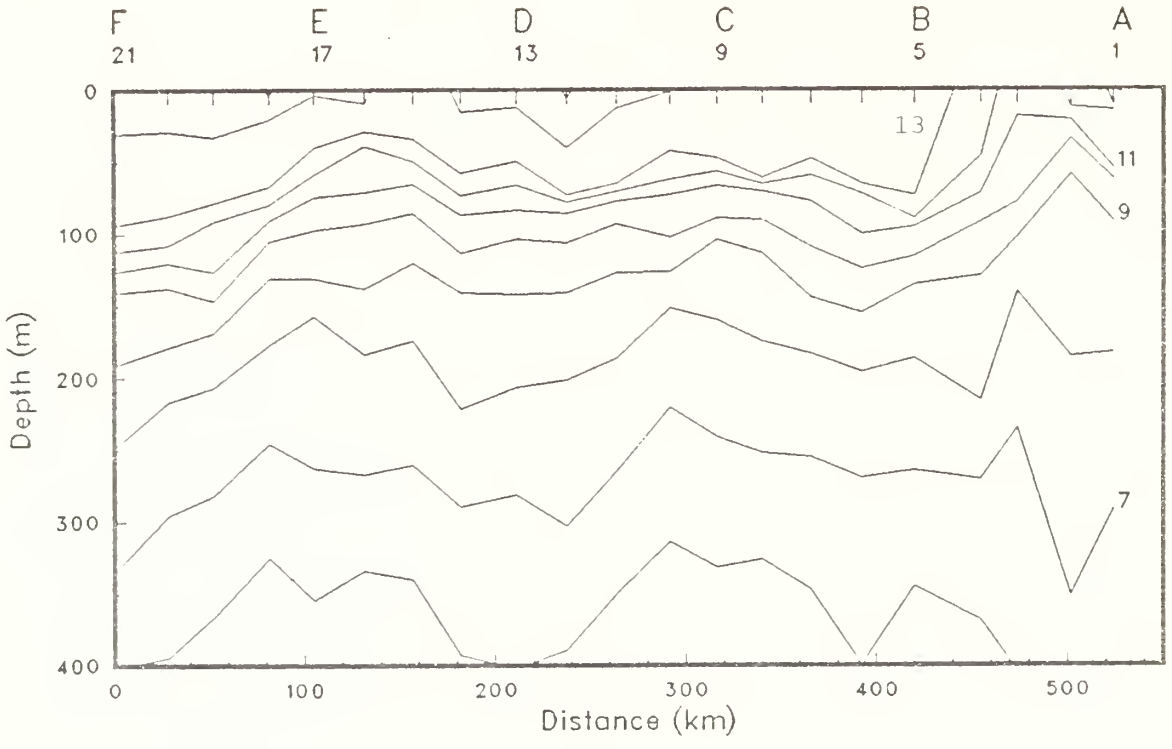

Figure 7(a): Isotherms from XBT's and CTD's. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if the cast was too shallow. (OPTOMA5, Leg D).

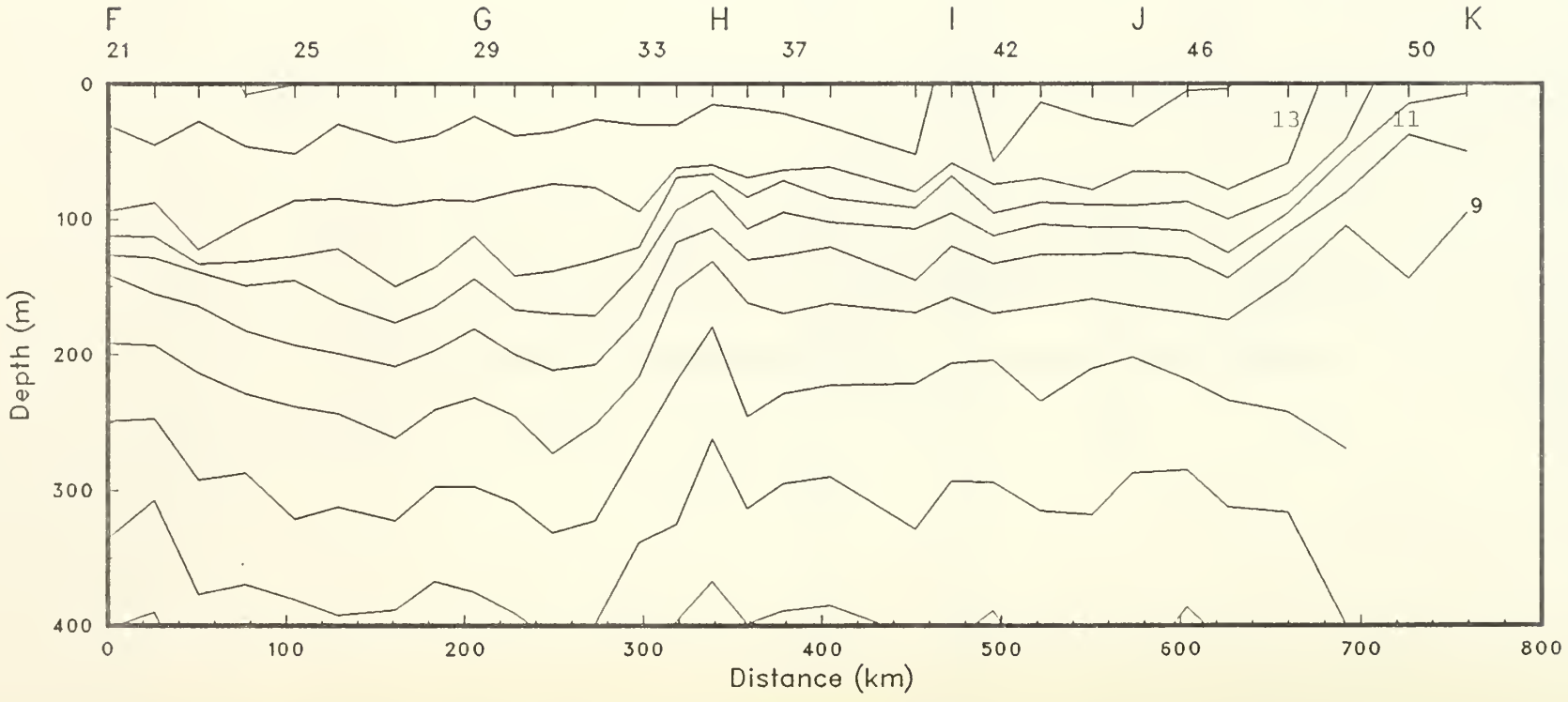
F
G
H
I
J
K
21
25
29
33
37
42
46
50
0
100
200
300
400
Depth (m)
13
11
9
0
100
200
300
400
500
600
700
800
Distance (km)

Figure 7(b)

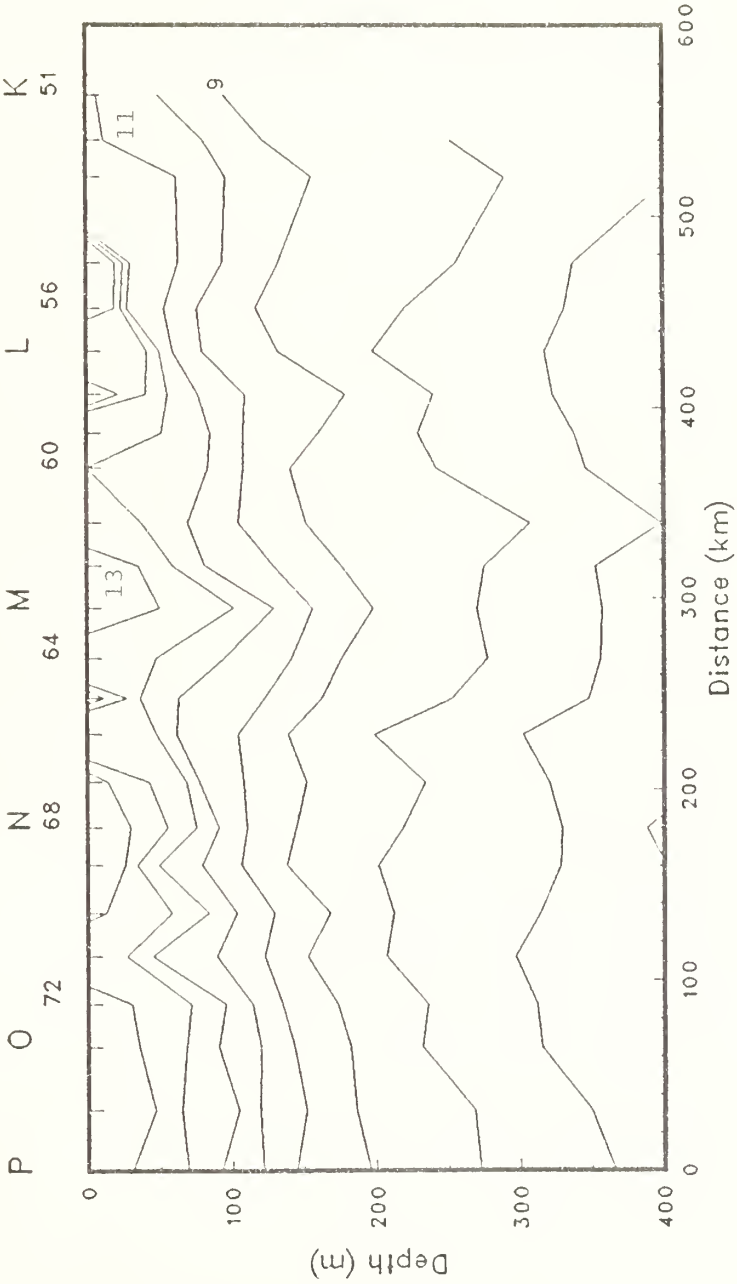
P
O
72
N
68
M
64
L
60
56
K
51
9
11
13
0
100
200
300
400
Depth (m)
0
100
200
300
400
500
600
Distance (km)

Figure 7(c)

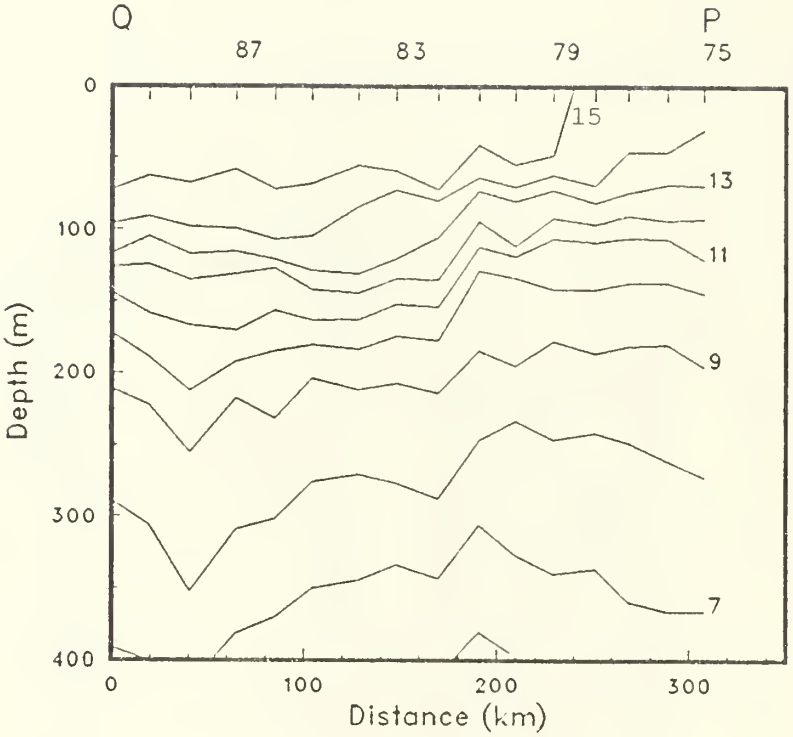

Figure 7(d)

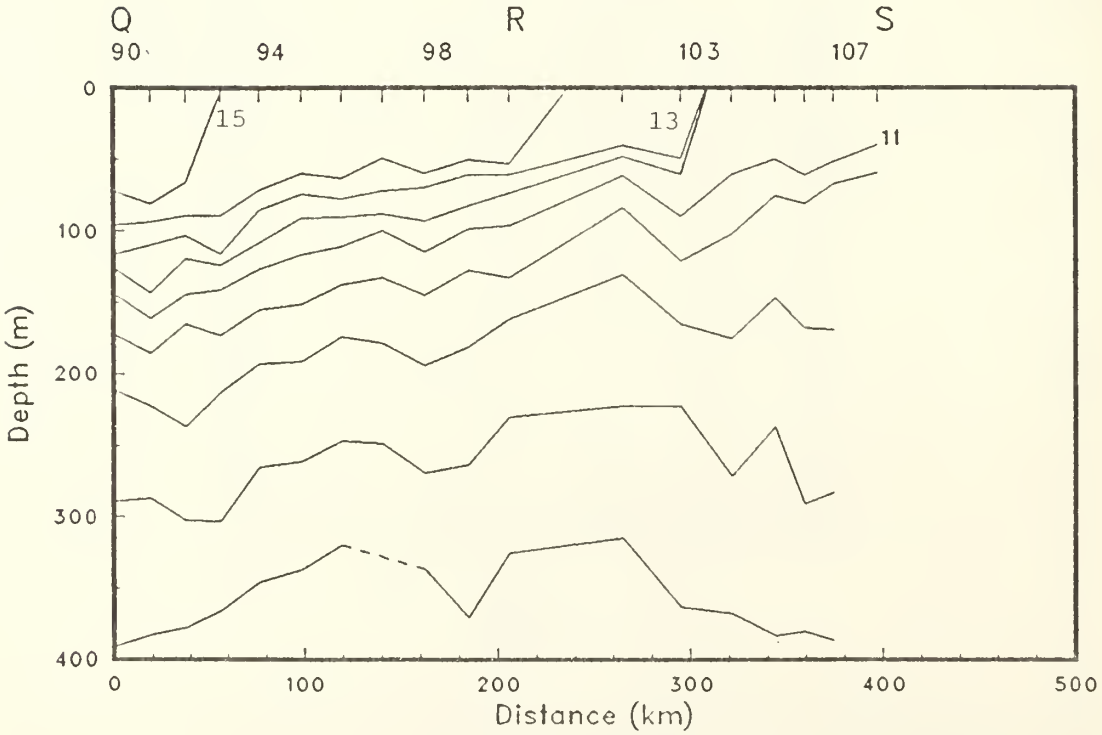

Figure 7(e)

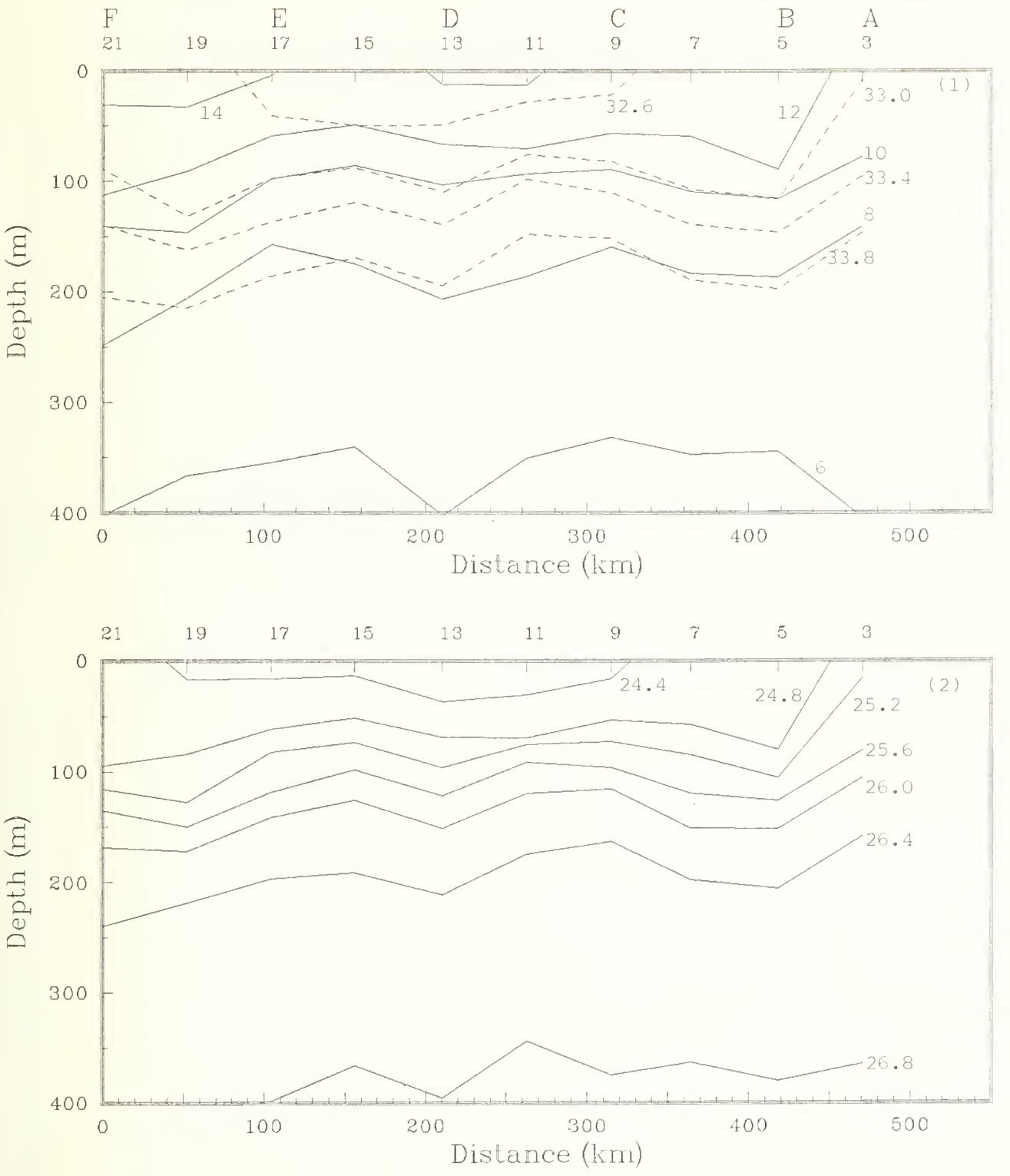

Figure 8(a): Isopleths of (1) temperature and salinity and (2) sigma-t from the CTD's. (OPTOMA5, Leg D).

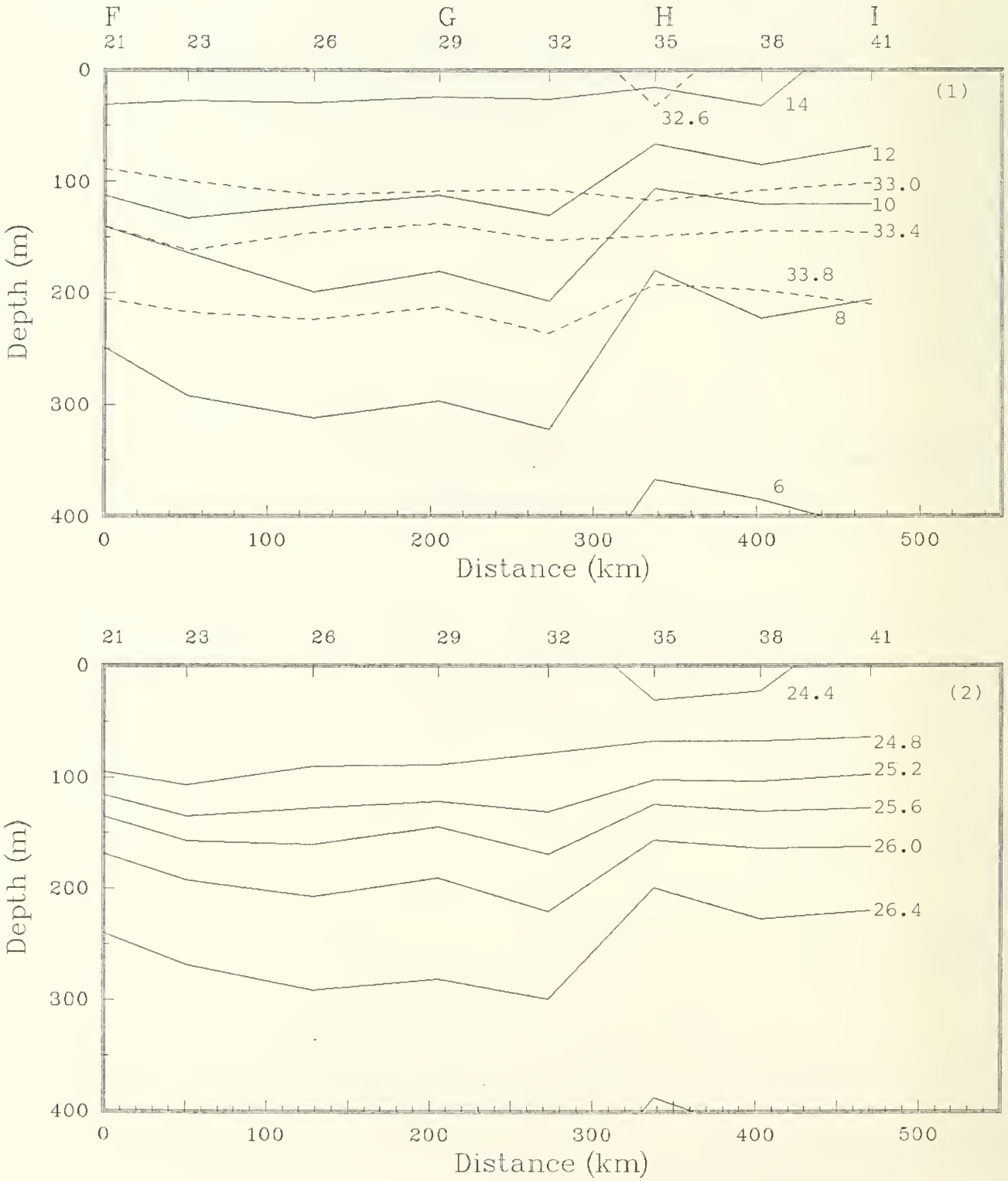
F
G
H
I
21
23
26
29
32
35
38
41
0
100
200
300
400
Depth (m)
(1)
14
32.6
12
33.0
10
33.4
33.8
8
6
0
100
200
300
400
500
Distance (km)
(2)
24.4
24.8
25.2
25.6
26.0
26.4

Figure 8(b)


P
O
N
M
L
75
73
71
68
66
63
60
0
100
200
300
400
Depth (m)
14
12
(1)
33.0
33.4
10
33.8
8
0
100
200
300
400
Distance (km)
75
73
71
68
66
63
60
0
100
200
300
400
Depth (m)
24.4
24.8
(2)
25.2
25.6
26.0
26.4
0
100
200
300
400
Distance (km)

Figure 8(c)

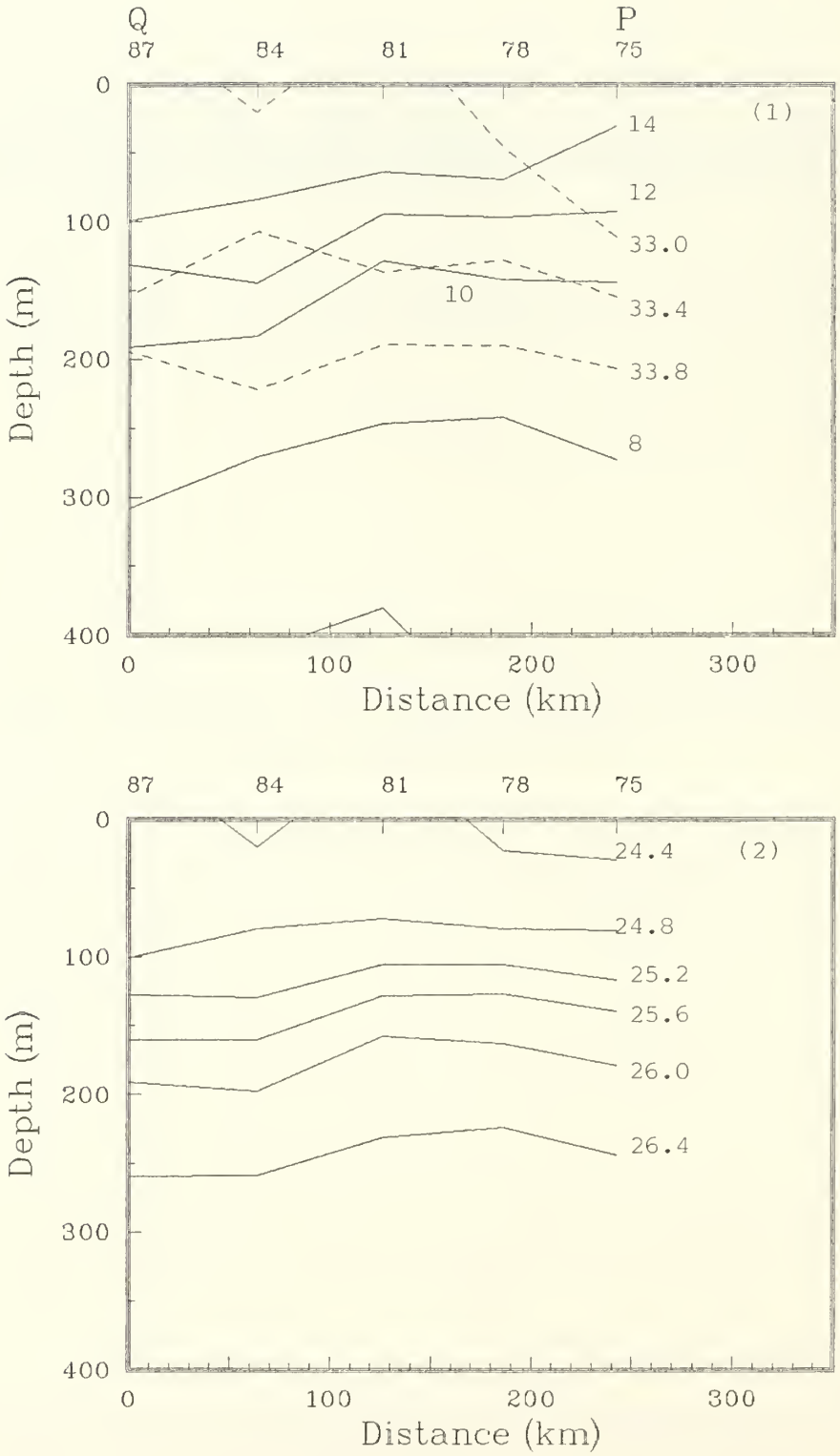
Q
P
87
84
81
78
75
(1)
14
12
33.0
10
33.4
33.8
8
Depth (m)
0
100
200
300
400
Distance (km)
(2)
24.4
24.8
25.2
25.6
26.0
26.4

Figure 8(d)

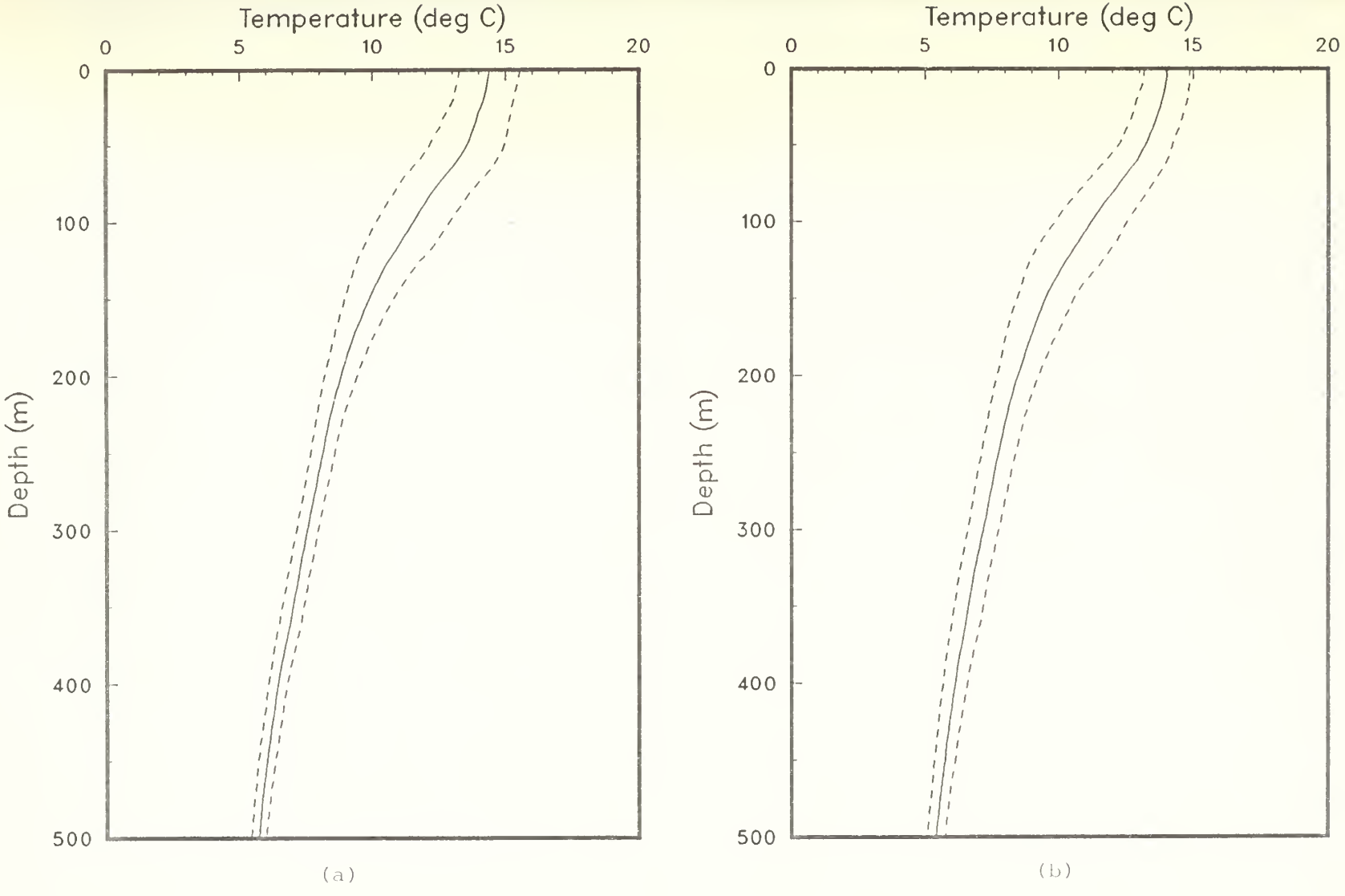

Figure 9: Profiles of $\overline{T(z)}$ with + and - the standard deviation from (a) XBT's and (b) CTD's. (OPTOMA5, Leg D).

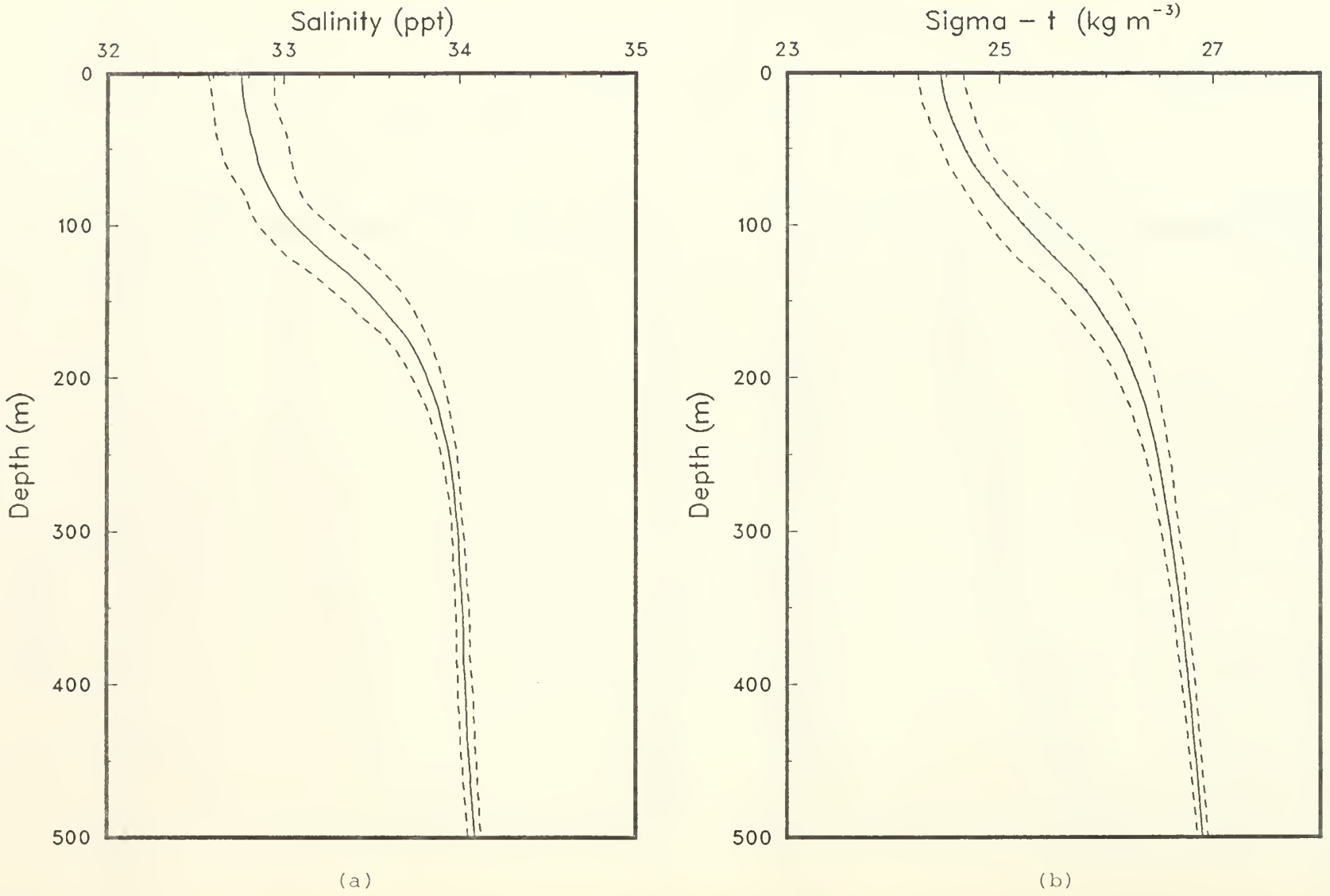

Figure 10: Profiles of (a) mean salinity and (b) mean sigma-t, with + and - the standard deviations, from the CTD's. (OPTOMA5, Leg D).

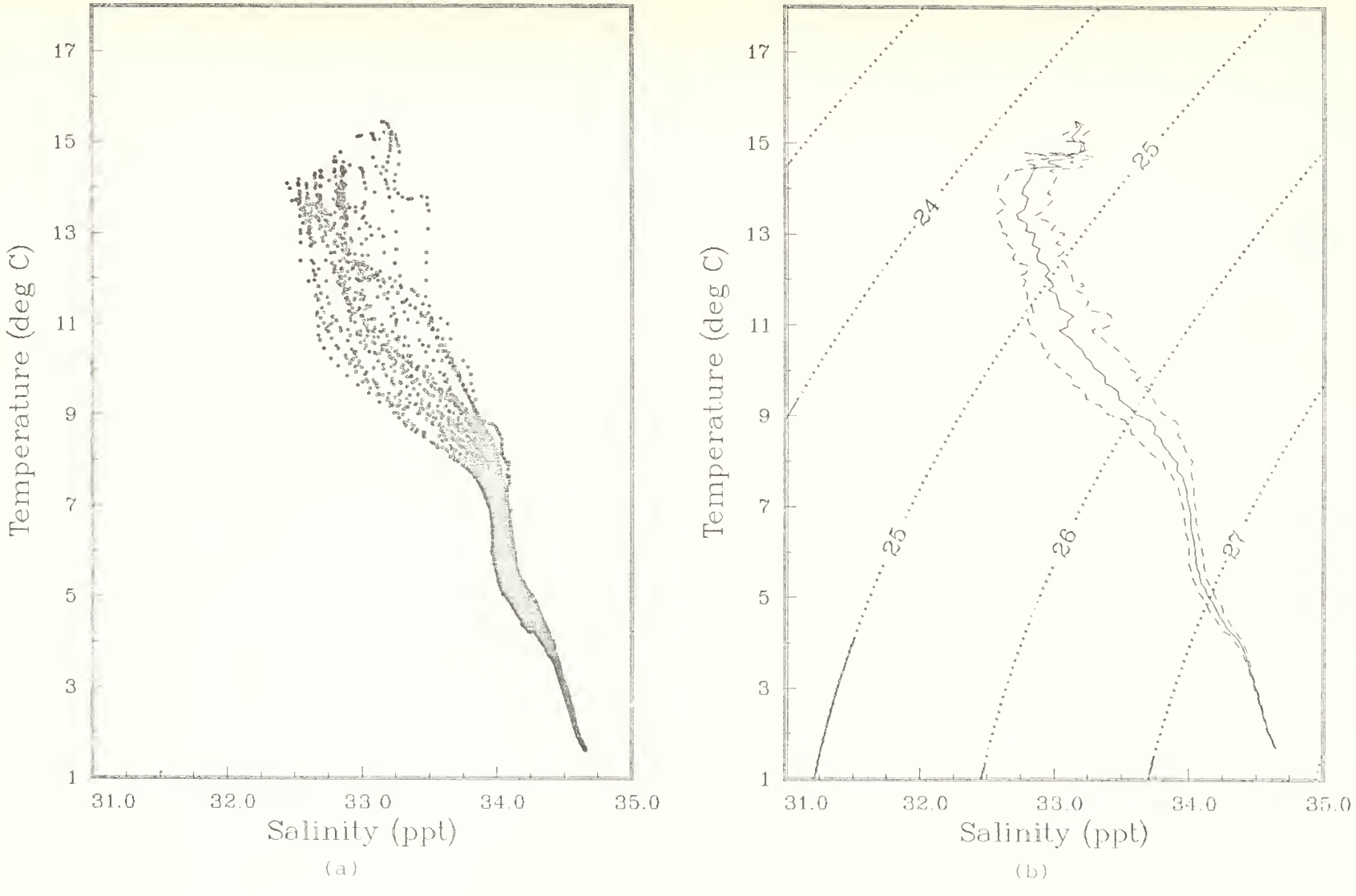

Figure 11: (a) T-S pairs and (b) mean T-S relationship, with + and − the standard deviation, and selected sigma-t contours, from the CTD casts. (OPTOMA5, Leg D).

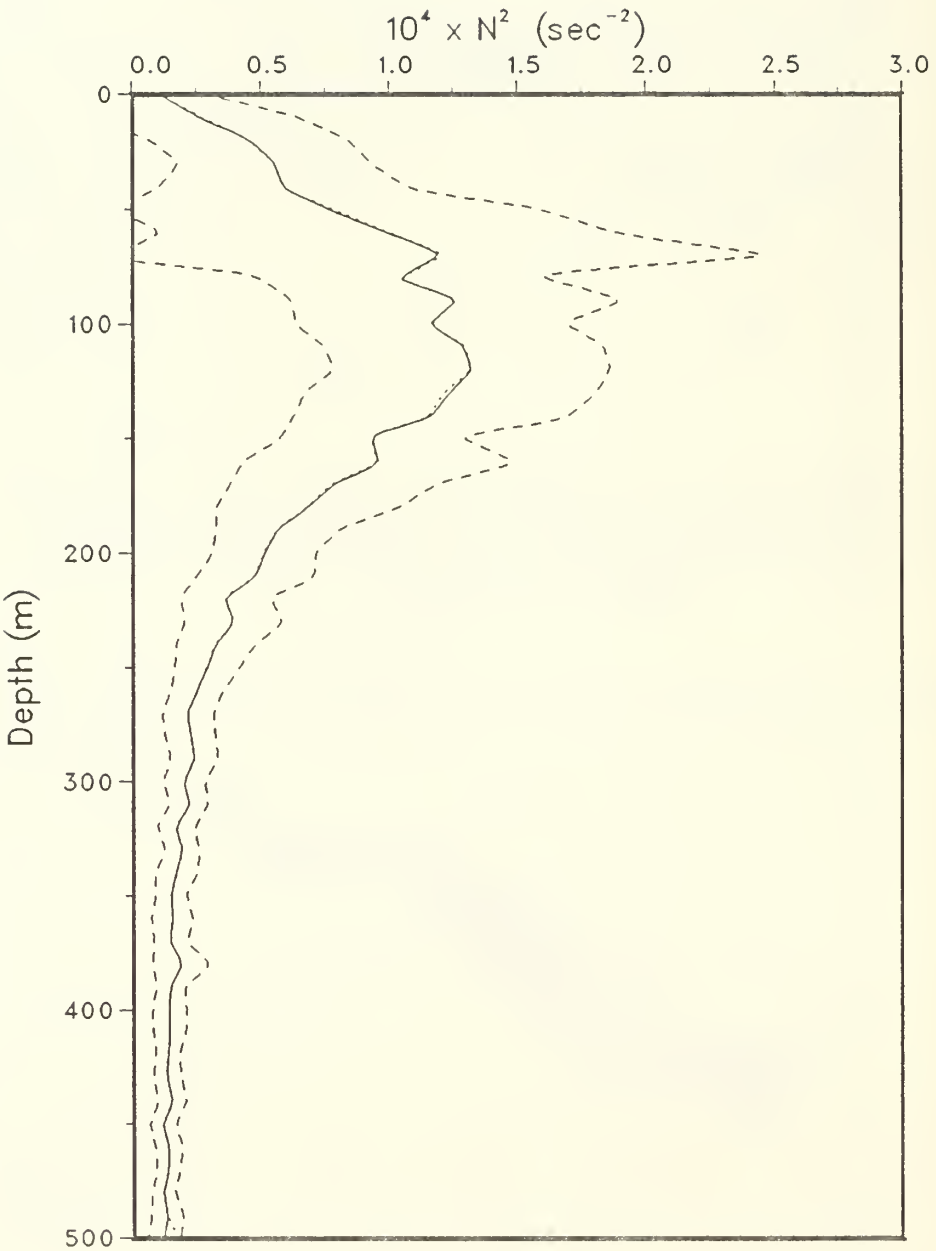

Figure 12: Profile of $\overline{N^2(z)}$ (——), with + and - the standard deviation (----), and the profile of N^2 from $\overline{T(z)}$ and $\overline{S(z)}$ (····). (OPTOMA5, Leg D).

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SECTION 2

OPTOMA5 Leg AI

15 - 22 June 1983

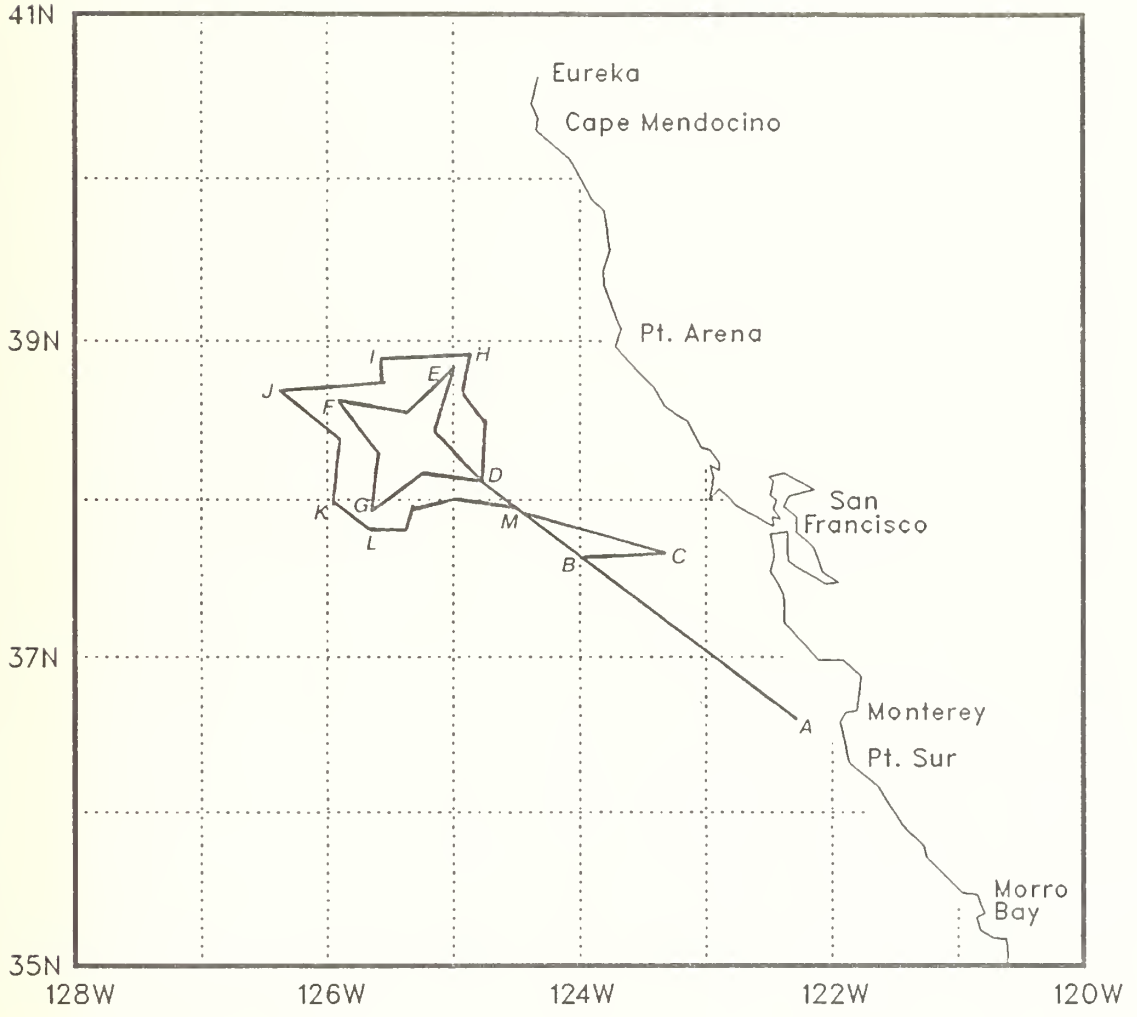


Figure 13: Cruise track for OPTOMA5, Leg AI with transect extremes identified by letter.

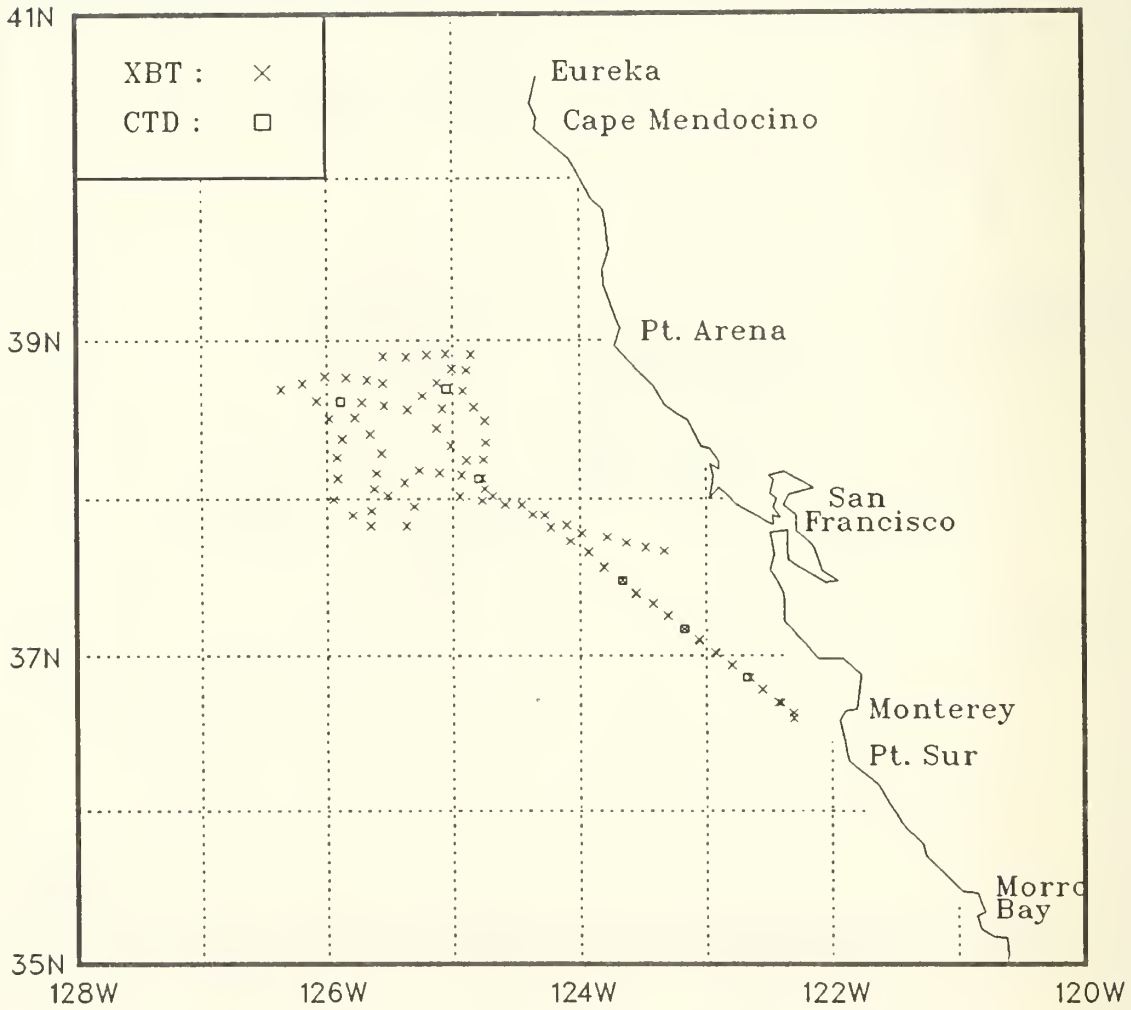


Figure 14: XBT and CTD locations for OPTOMA5, Leg AI.

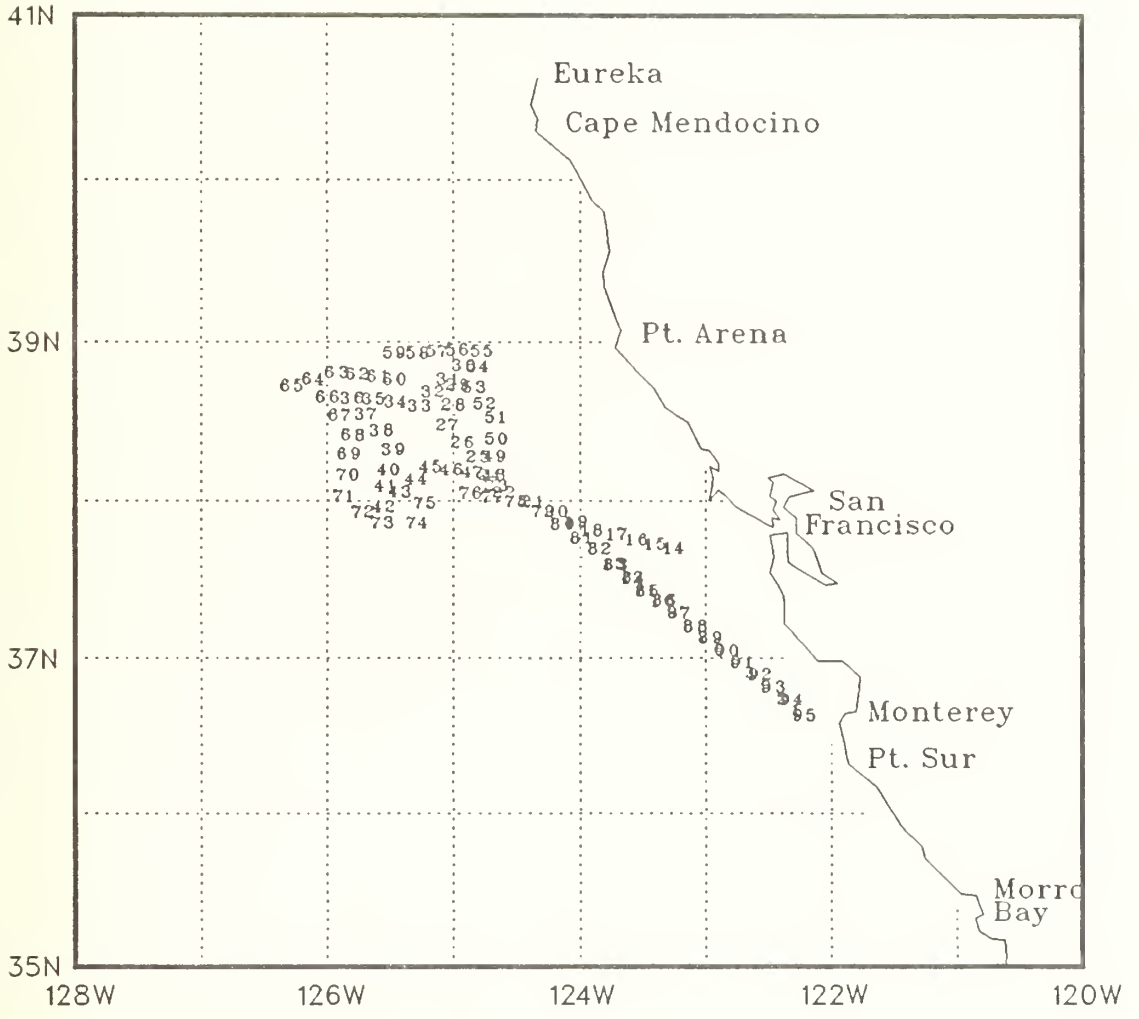


Figure 15: Station numbers for OPTOMA5, Leg AI.

Table 3: Leg AI Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
1	XBT	83166	1901	36.38	122.18	12.5			
2	XBT	83166	2000	36.42	122.25	13.1			
3	XBT	83166	2102	36.47	122.33	13.0			
4	CTD	83166	2233	36.52	122.41	14.0	32.97	14.1	32.97
5	XBT	83166	2353	36.57	122.48	13.9			
6	XBT	83167	102	37.01	122.56	13.9			
7	XBT	83167	217	37.06	123.03	13.6			
8	CTD	83167	339	37.10	123.10	12.9	33.04	13.0	32.79
9	XBT	83167	553	37.16	123.18	13.6			
10	XBT	83167	745	37.20	123.25	14.5			
11	XBT	83167	1006	37.24	123.33	14.8			
12	CTD	83167	1245	37.29	123.40	14.0	32.82	14.0	32.79
13	XBT	83167	1459	37.34	123.48	14.4			
14	XBT	83169	152	37.40	123.20	13.9			
15	XBT	83169	246	37.42	123.29	14.3			
16	XBT	83169	342	37.44	123.38	14.0			
17	XBT	83169	437	37.46	123.47	14.2			
18	XBT	83169	548	37.47	123.59	12.2			
19	XBT	83169	639	37.50	124.06	12.5			
20	XBT	83169	742	37.54	124.17	12.3			
21	XBT	83169	846	37.58	124.27	12.5			
22	XBT	83169	946	38.01	124.41	12.8			
23	XBT	83169	1043	38.04	124.45	13.3			
24	CTD	83169	1211	38.08	124.48	13.0	32.82	13.1	32.84
25	XBT	83169	1328	38.15	124.54	13.6			
26	XBT	83169	1440	38.20	125.01	13.6			
27	XBT	83169	1557	38.27	125.08	13.6			
28	XBT	83169	1717	38.34	125.05	13.7			
29	CTD	83169	1830	38.42	125.03	13.7	32.71	14.1	32.70
30	XBT	83169	2002	38.49	125.00	13.9			
31	XBT	83169	2059	38.44	125.08	13.7			
32	XBT	83169	2154	38.39	125.15	13.8			
33	XBT	83169	2246	38.34	125.21	13.9			
34	XBT	83170	17	38.36	125.33	14.6			
35	XBT	83170	142	38.37	125.43	14.4			
36	CTD	83170	317	38.37	125.53	14.4	32.71	14.4	32.76
37	XBT	83170	426	38.31	125.47	14.1			
38	XBT	83170	520	38.25	125.39	14.2			
39	XBT	83170	621	38.18	125.34	14.0			
40	XBT	83170	711	38.10	125.36	14.1			
41	XBT	83170	754	38.04	125.38	14.0			
42	XBT	83170	843	37.56	125.39	13.5			
43	XBT	83170	1015	38.02	125.31	13.7			
44	XBT	83170	1144	38.07	125.23	13.1			
45	XBT	83170	1308	38.11	125.16	13.2			
46	XBT	83170	1411	38.10	125.06	13.0			
47	XBT	83170	1522	38.09	124.56	13.4			

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
48	XBT	83170	1635	38.08	124.46	13.1			
49	XBT	83170	2149	38.15	124.46	14.0			
50	XBT	83171	59	38.22	124.45	13.8			
51	XBT	83171	516	38.30	124.45	13.7			
52	XBT	83171	808	38.35	124.50	13.6			
53	XBT	83171	1102	38.41	124.55	13.6			
54	XBT	83171	1333	38.49	124.53	13.6			
55	XBT	83171	1516	38.55	124.51	13.8			
56	XBT	83171	1706	38.55	125.03	14.0			
57	XBT	83171	1825	38.55	125.12	14.1			
58	XBT	83171	1941	38.54	125.22	13.7			
59	XBT	83171	2113	38.54	125.33	14.3			
60	XBT	83171	2235	38.44	125.33	14.1			
61	XBT	83171	2348	38.45	125.41	14.4			
62	XBT	83172	118	38.46	125.51	14.5			
63	XBT	83172	256	38.47	126.01	14.6			
64	XBT	83172	428	38.44	126.12	14.7			
65	XBT	83172	552	38.42	126.22	14.9			
66	XBT	83172	908	38.37	126.05	14.5			
67	XBT	83172	1025	38.31	125.59	14.4			
68	XBT	83172	1136	38.23	125.53	14.3			
69	XBT	83172	1234	38.16	125.55	14.2			
70	XBT	83172	1339	38.08	125.55	14.5			
71	XBT	83172	1445	38.00	125.57	14.0			
72	XBT	83172	1602	37.54	125.48	14.1			
73	XBT	83172	1702	37.50	125.39	13.7			
74	XBT	83172	1844	37.50	125.22	13.7			
75	XBT	83172	1939	37.57	125.18	13.6			
76	XBT	83172	2158	38.01	124.57	12.3			
77	XBT	83172	2305	38.00	124.46	12.0			
78	XBT	83173	12	37.58	124.35	12.5			
79	XBT	83173	131	37.54	124.23	13.3			
80	XBT	83173	228	37.49	124.14	13.4			
81	XBT	83173	330	37.44	124.04	13.8			
82	XBT	83173	425	37.40	123.56	14.2			
83	XBT	83173	532	37.34	123.48	13.3			
84	XBT	83173	631	37.29	123.40	12.0			
85	XBT	83173	722	37.24	123.33	13.3			
86	XBT	83173	813	37.20	123.25	13.4			
87	XBT	83173	906	37.15	123.18	13.5			
88	XBT	83173	1005	37.10	123.10	13.2			
89	XBT	83173	1055	37.06	123.03	12.4			
90	XBT	83173	1152	37.01	122.55	12.1			
91	XBT	83173	1243	36.57	122.48	12.3			
92	XBT	83173	1335	36.52	122.39	13.2			
93	XBT	83173	1424	36.47	122.33	13.0			
94	XBT	83173	1520	36.42	122.24	13.5			
95	XBT	83173	1607	36.36	122.18	12.3			

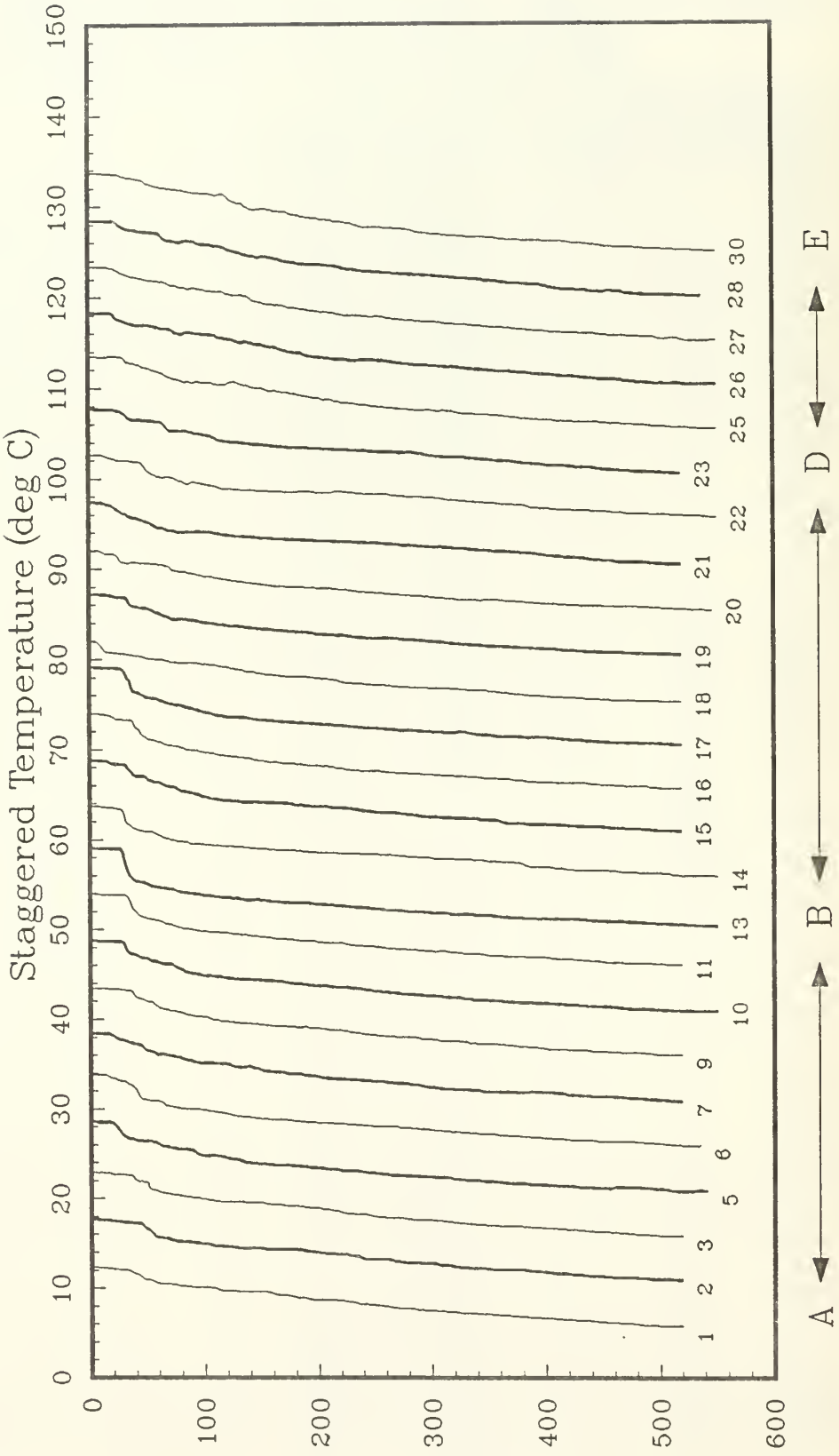


Figure 16(a): Staggered temperature profiles from the XBT's. Profiles are staggered by a multiple of 5C. (OPTOMA5, Leg AI).

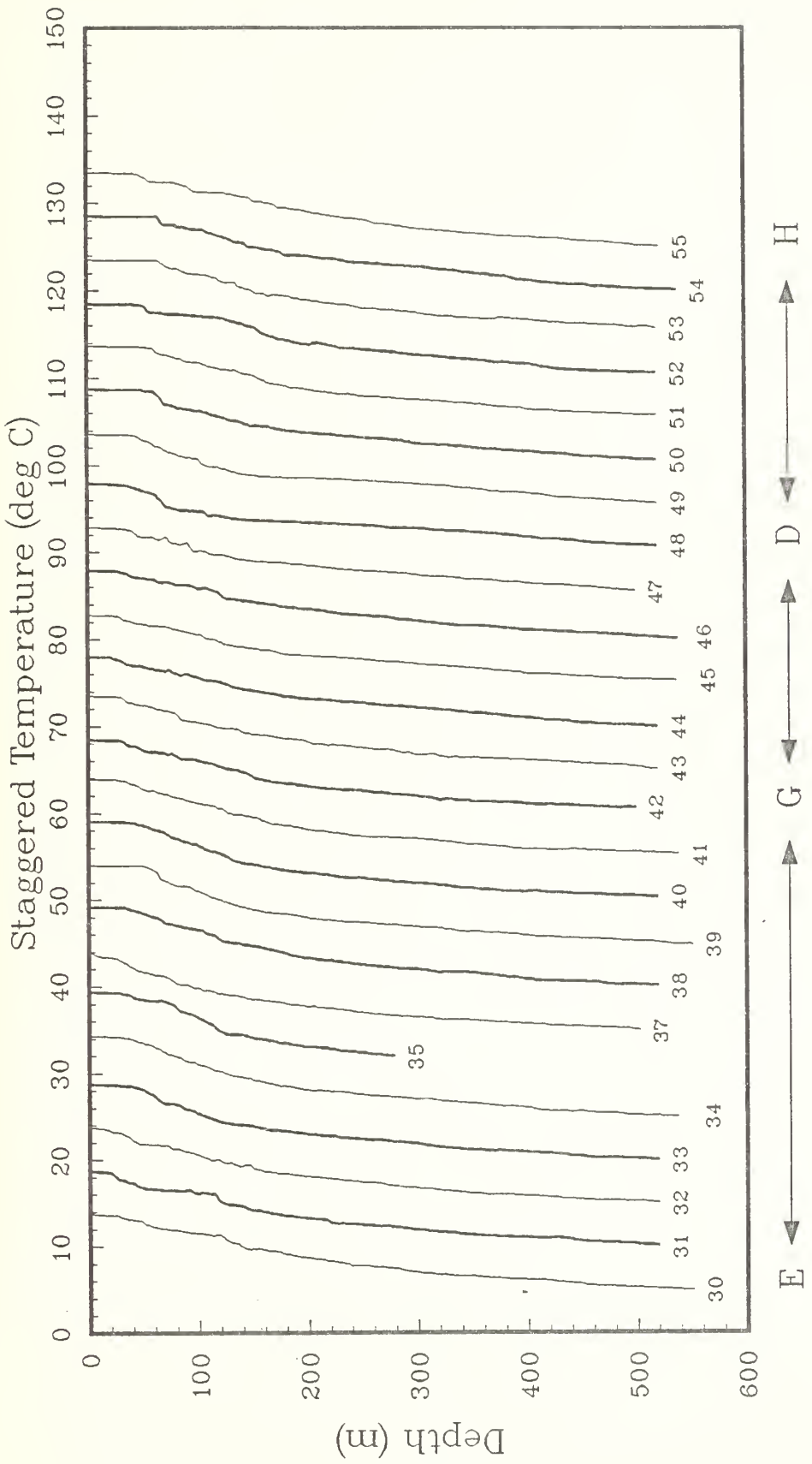

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Depth (m)
0
100
200
300
400
500
600
30
31
32
33
34
35
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
E
G
D
H

Figure 16(b)

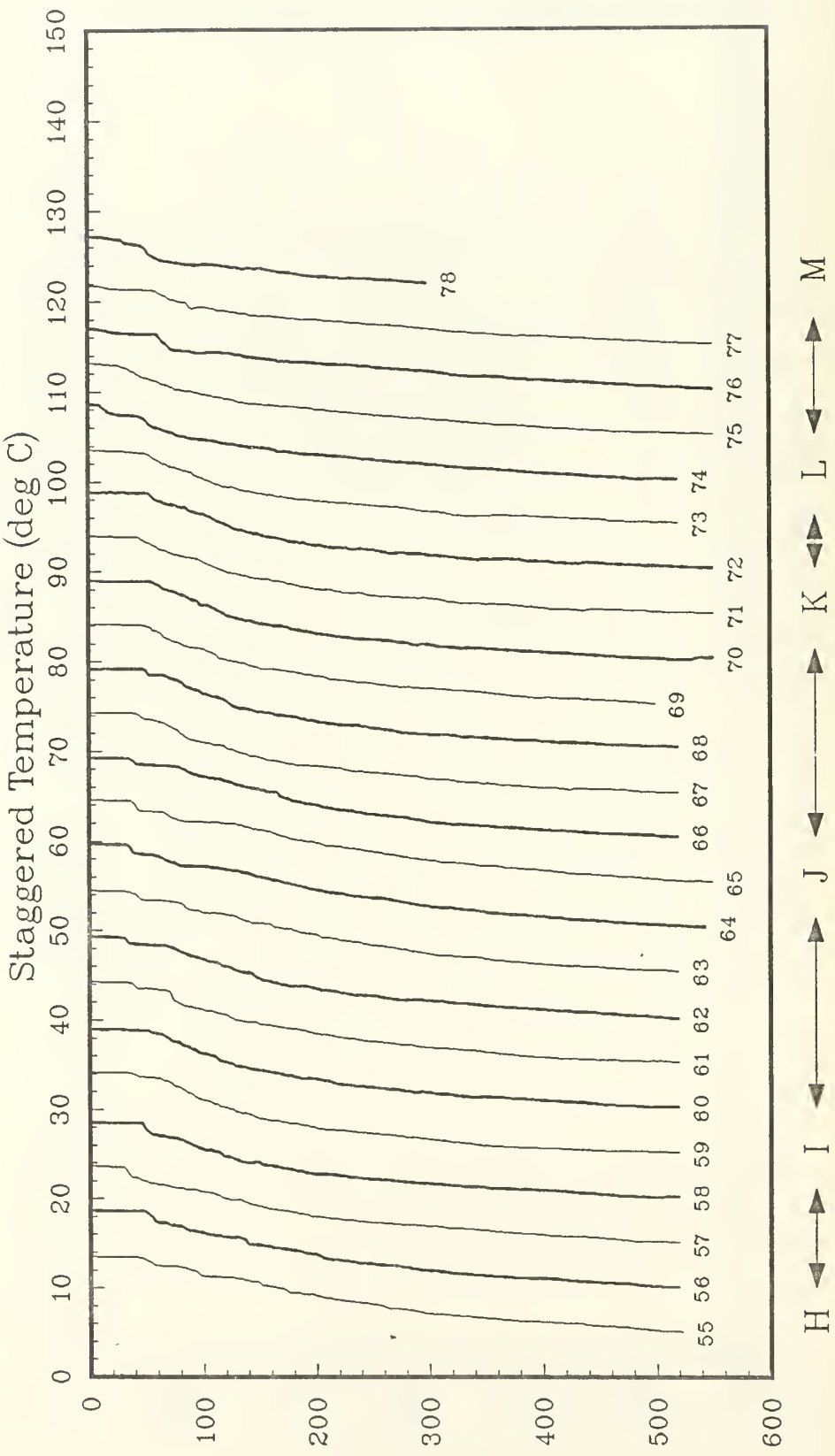

Staggered Temperature (deg C)
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Depth (m)
0 100 200 300 400 500 600
55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78
H I J K L M

Figure 16 (c)

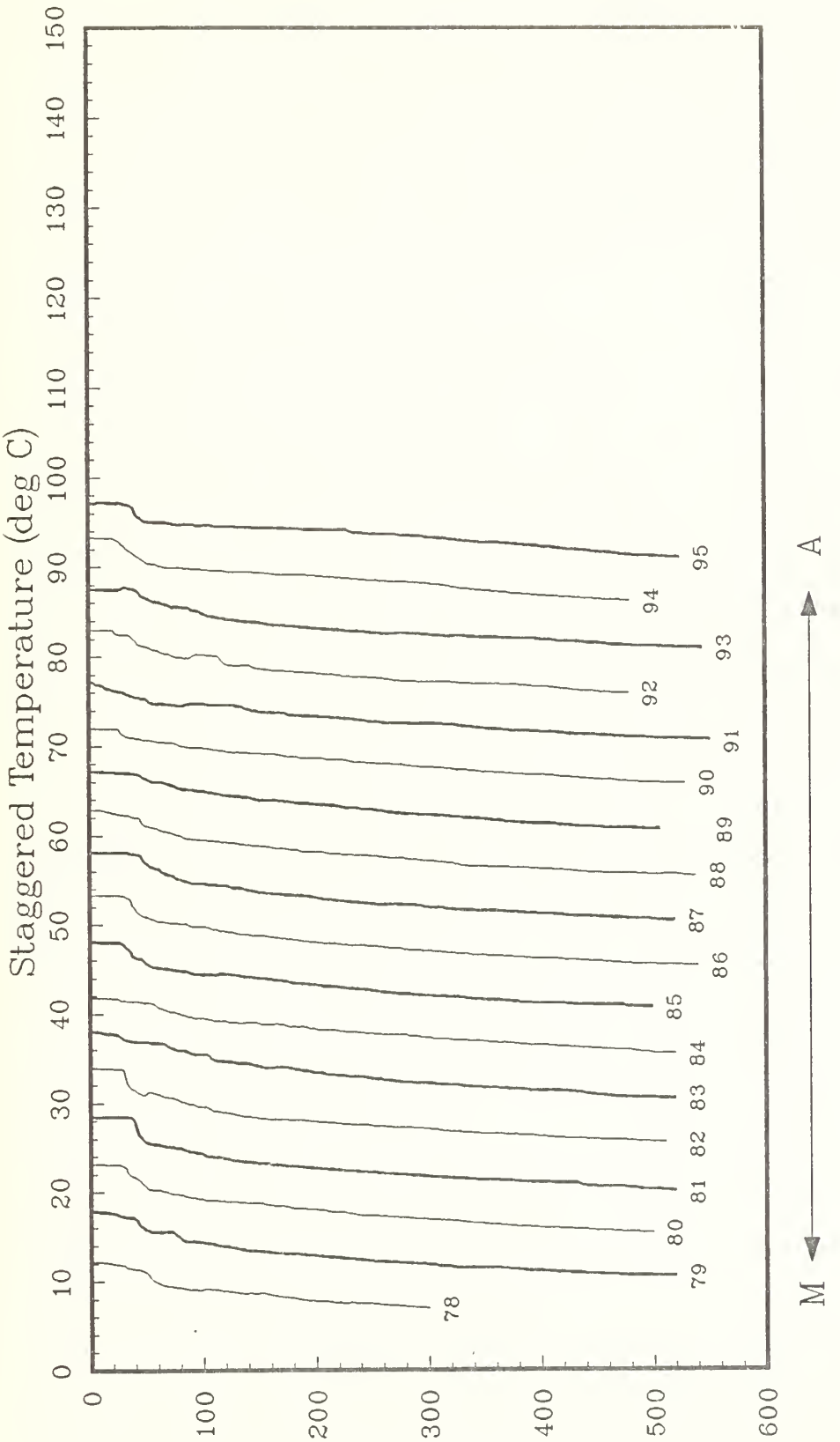

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Depth (m)
0
100
200
300
400
500
600
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
M
A

Figure 16(d)

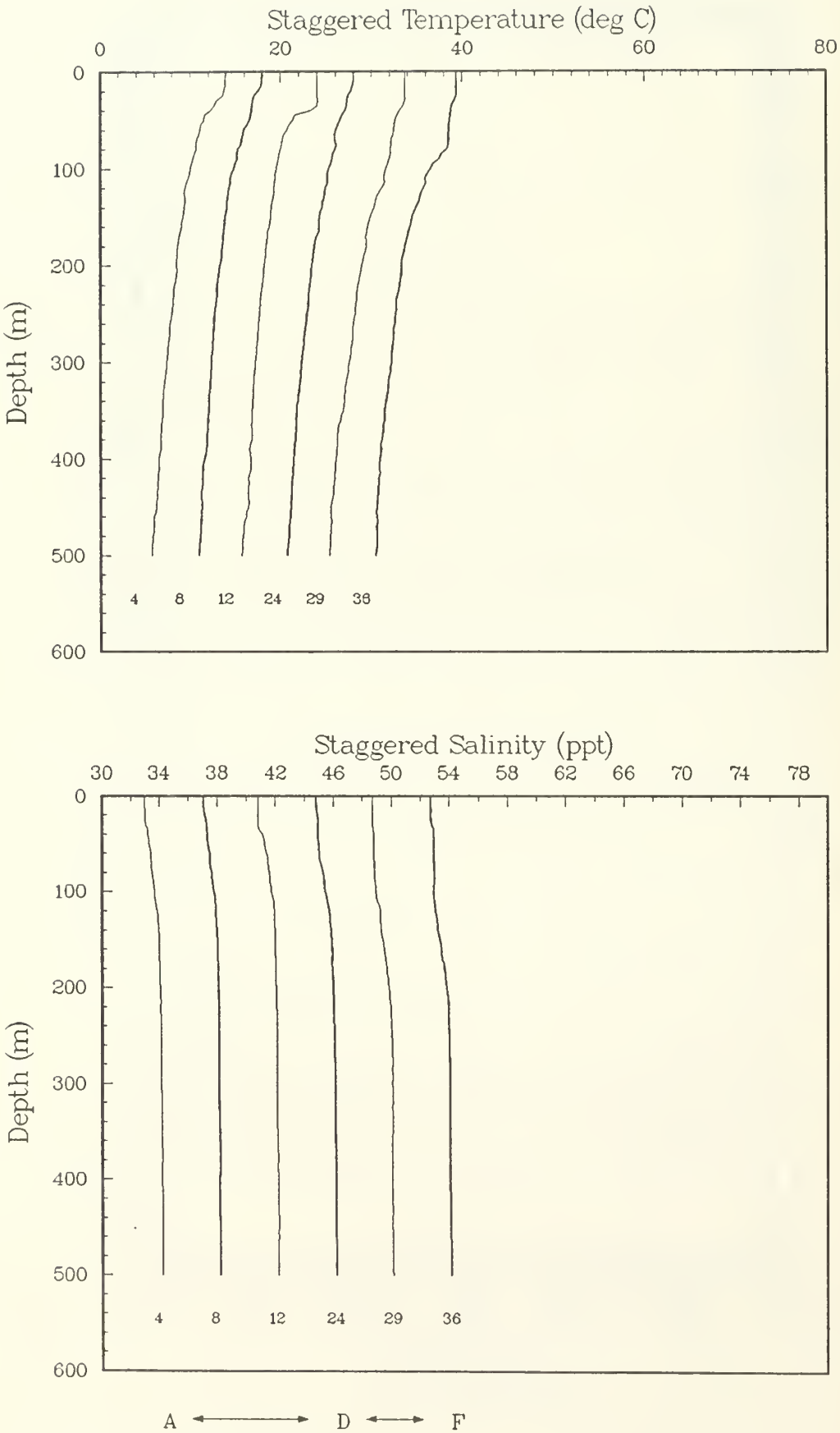
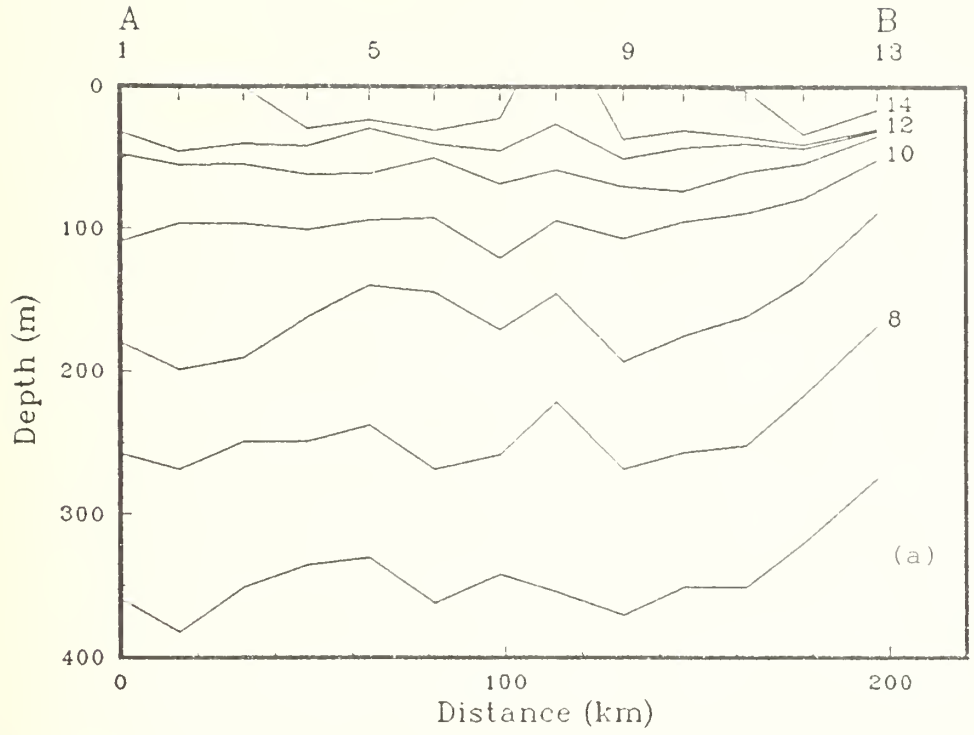


Figure 17: CTD temperature profiles, staggered by multiples of 5C, and salinity profiles staggered by multiples of 4ppt. (OPTOMA5, Leg AI).



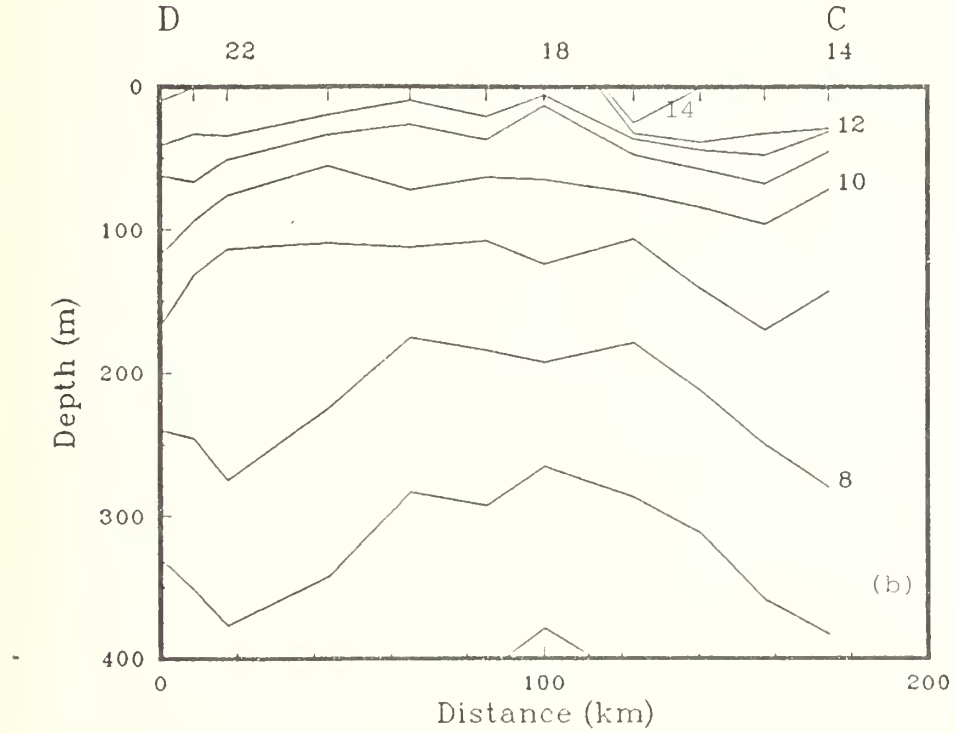


Figure 18(a), (b): Isotherms from XBT's and CTD's. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if the cast was too shallow. (OPTOMA5, Leg AI).

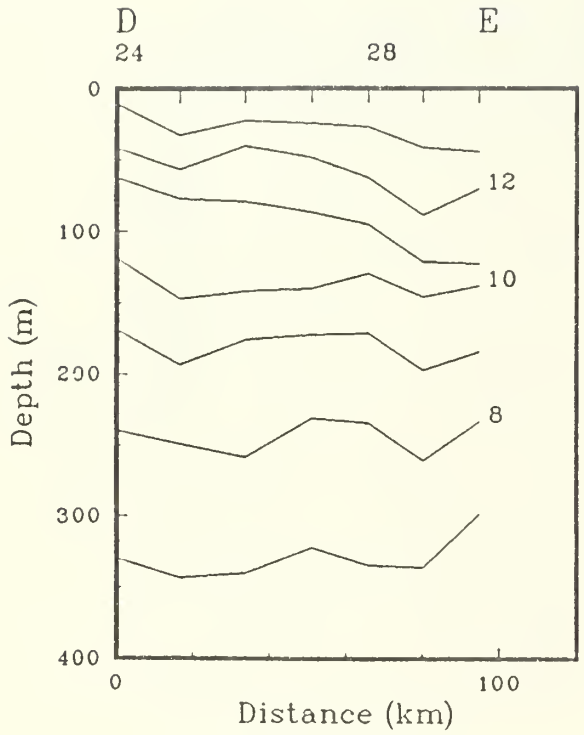


Figure 18(c)

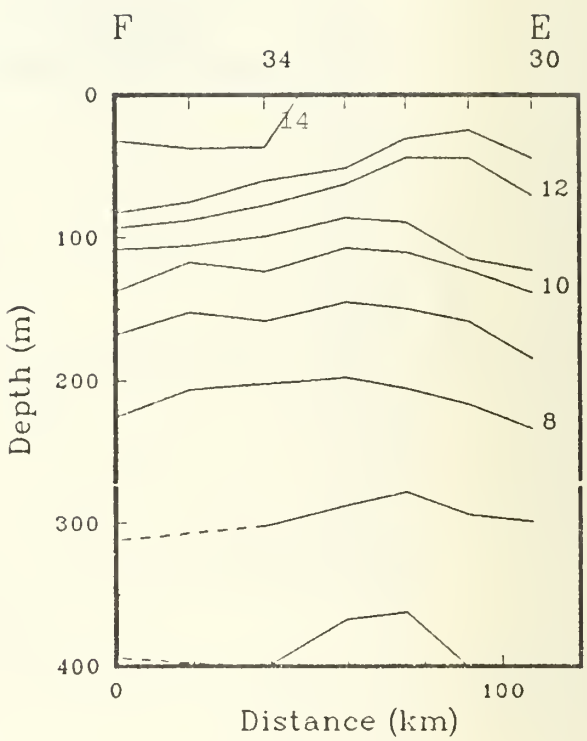


Figure 18(d)

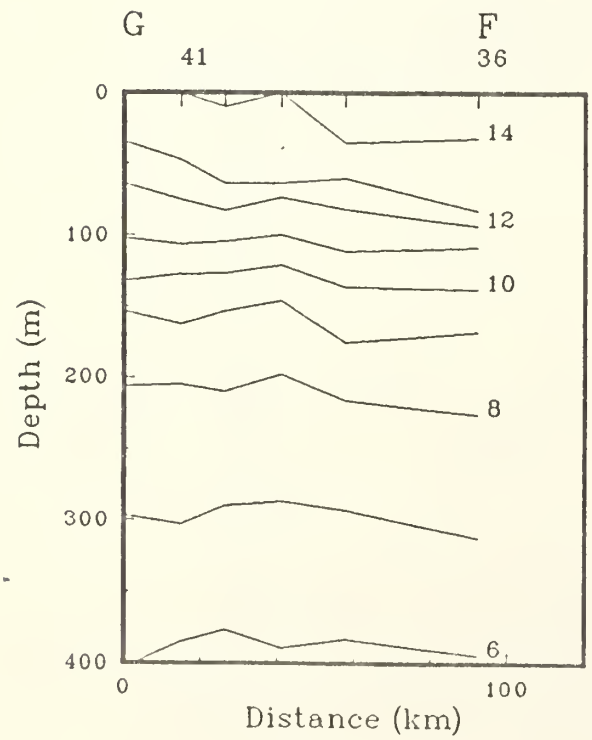


Figure 18(e)

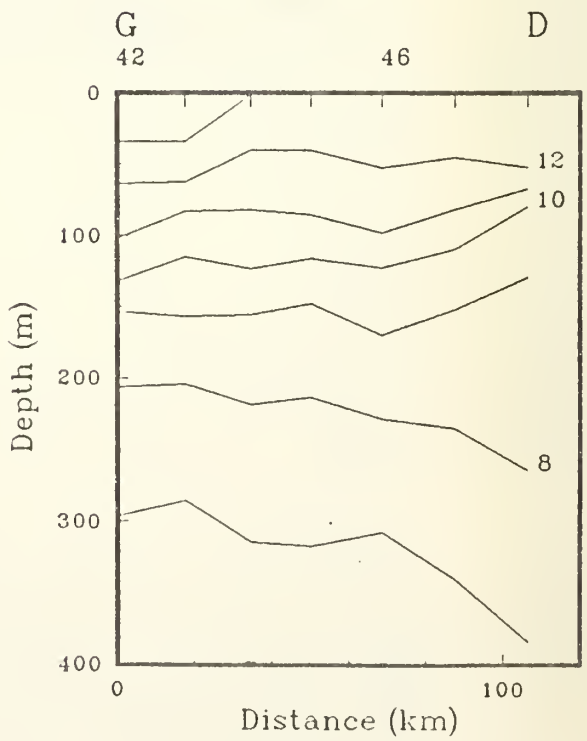


Figure 18(f)

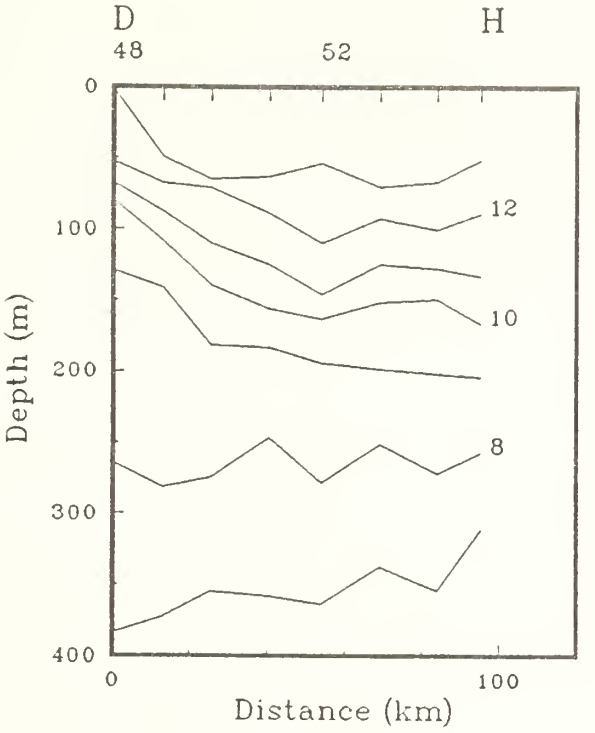


Figure 18(g)

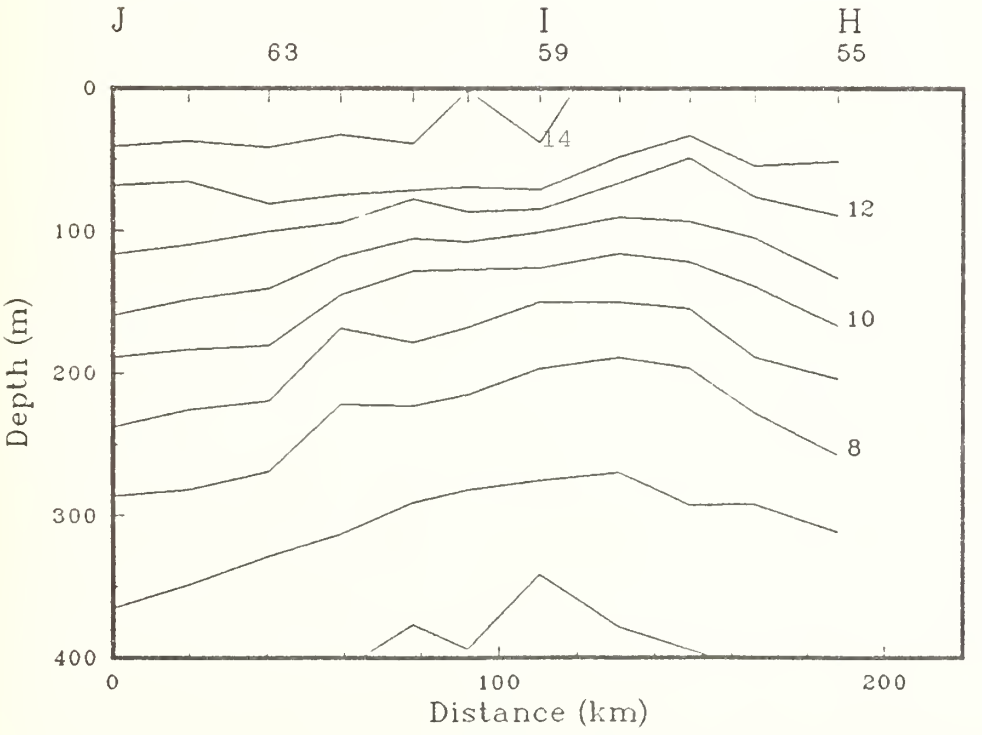


Figure 18(h)

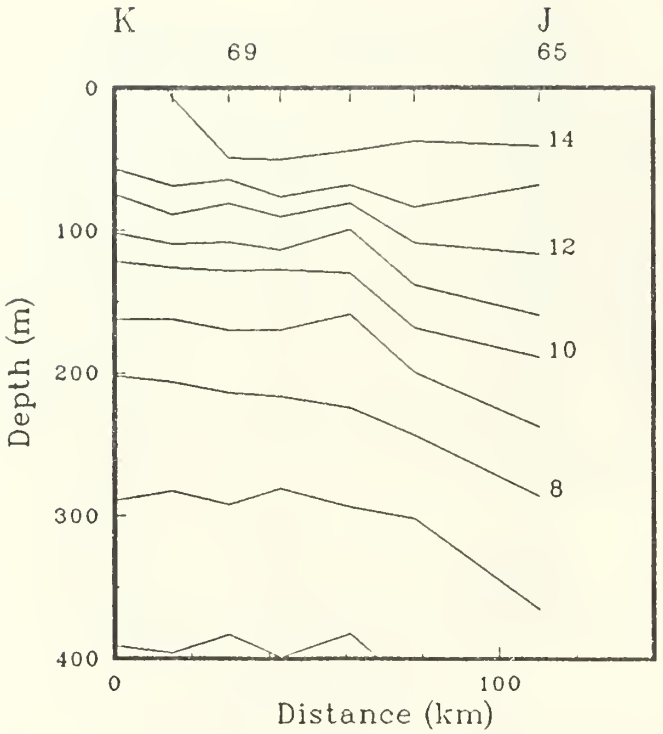


Figure 18(i)

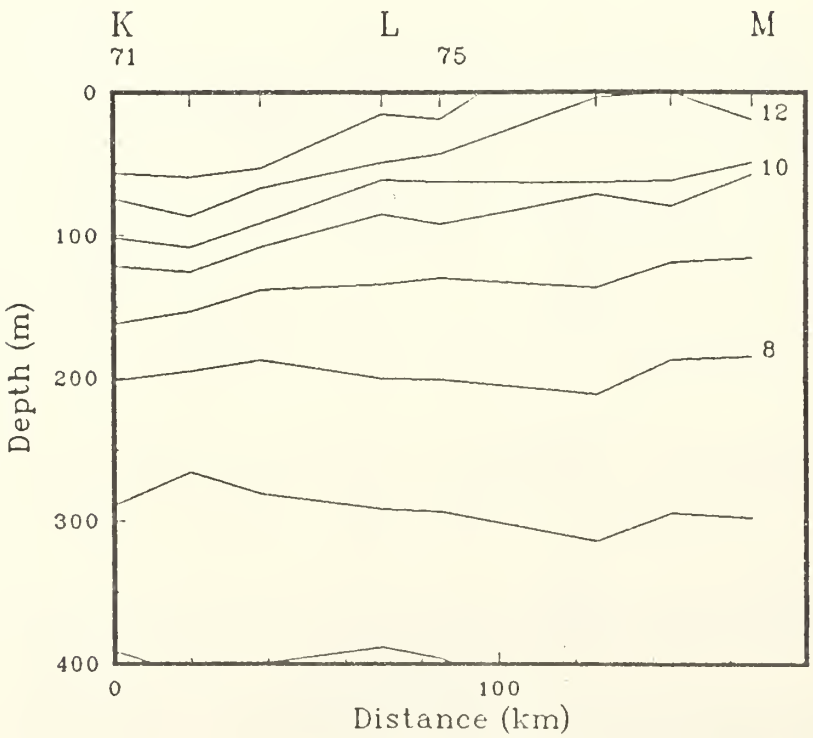


Figure 18(j)

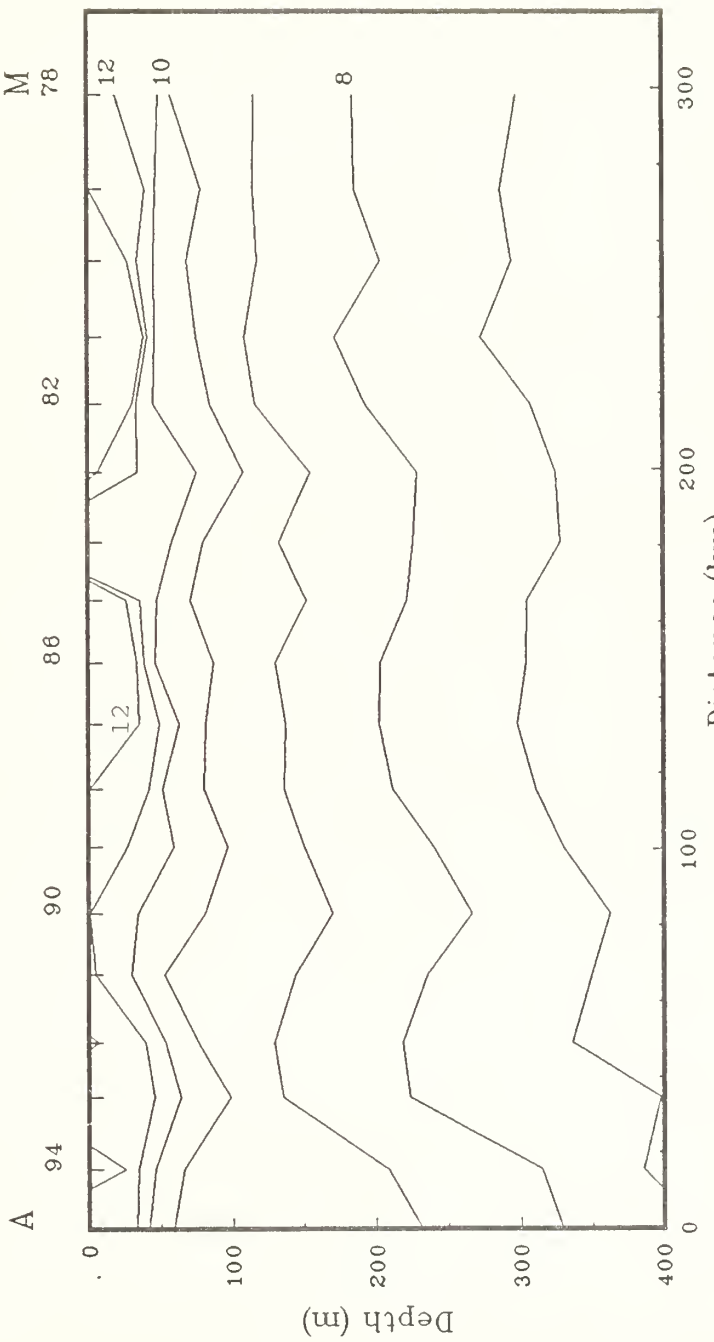
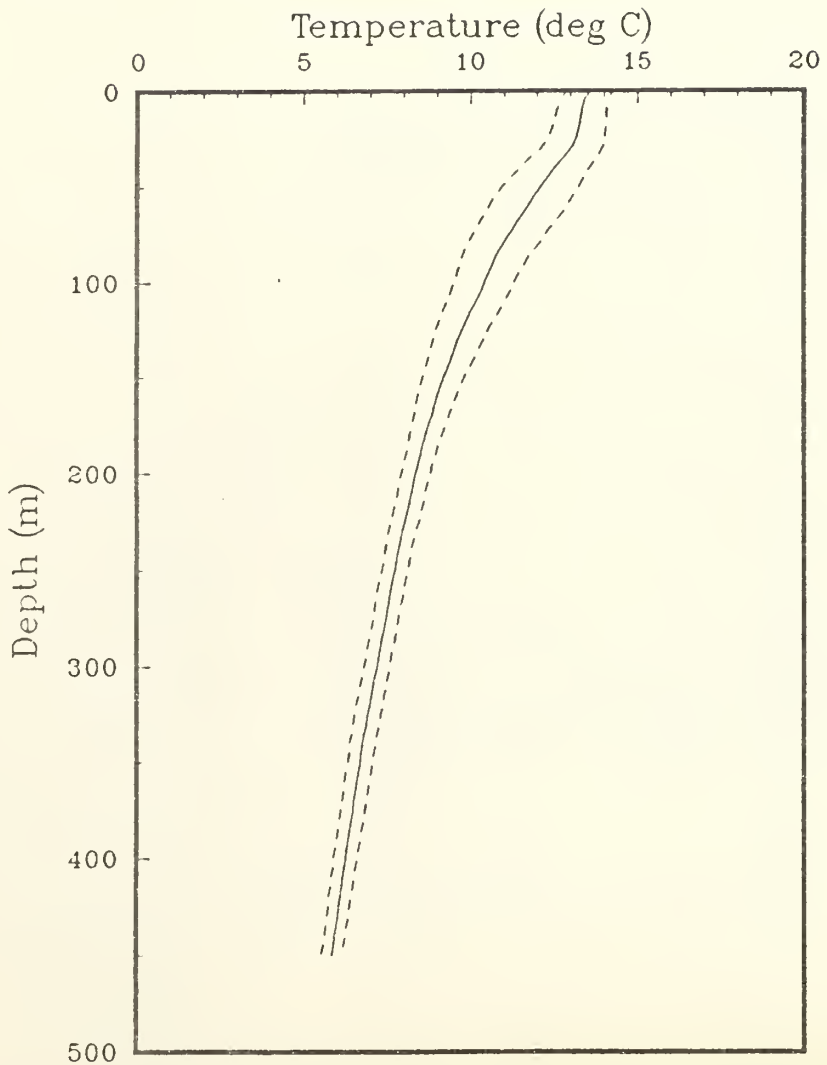
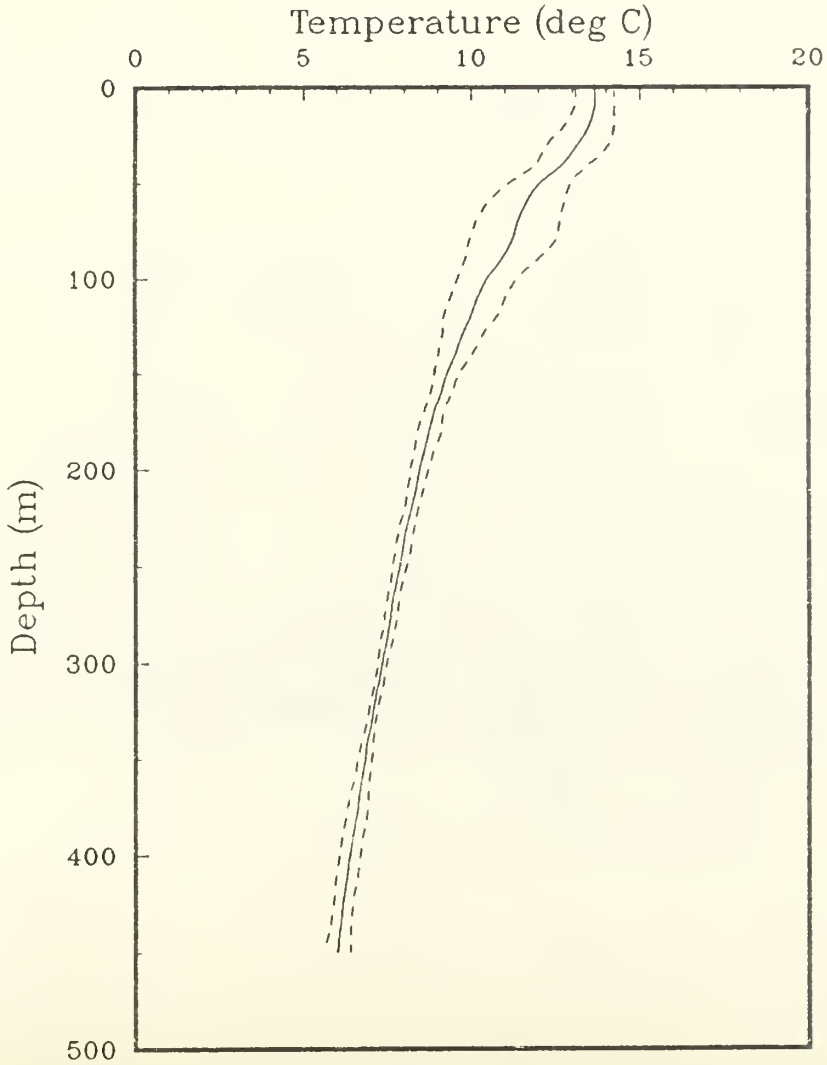

A
94
90
86
82
M
78
12
10
8
12
0
100
200
300
400
Depth (m)
0
100
200
300
Distance (km)

Figure 18(k)



(a)



(b)

Figure 19: Profile of $\overline{T(z)}$ with + and - the standard deviation from (a) XBT's and (b) CTD's. (OPTOMA5, Leg AI).

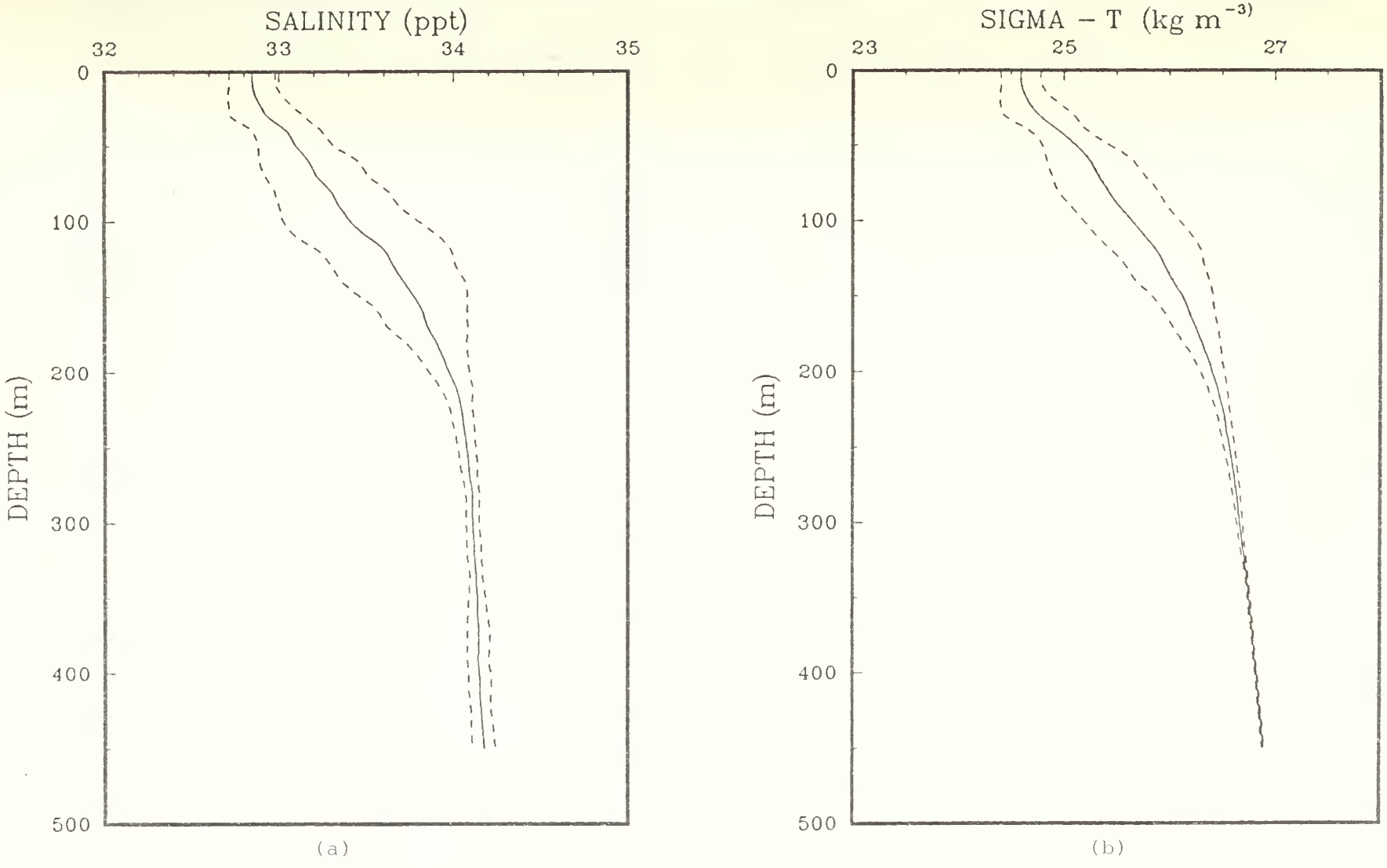


Figure 20: Profiles of (a) mean salinity and (b) mean sigma-t, with + and - the standard deviations, from the CTD's. (OPTOMA5, Leg AI).

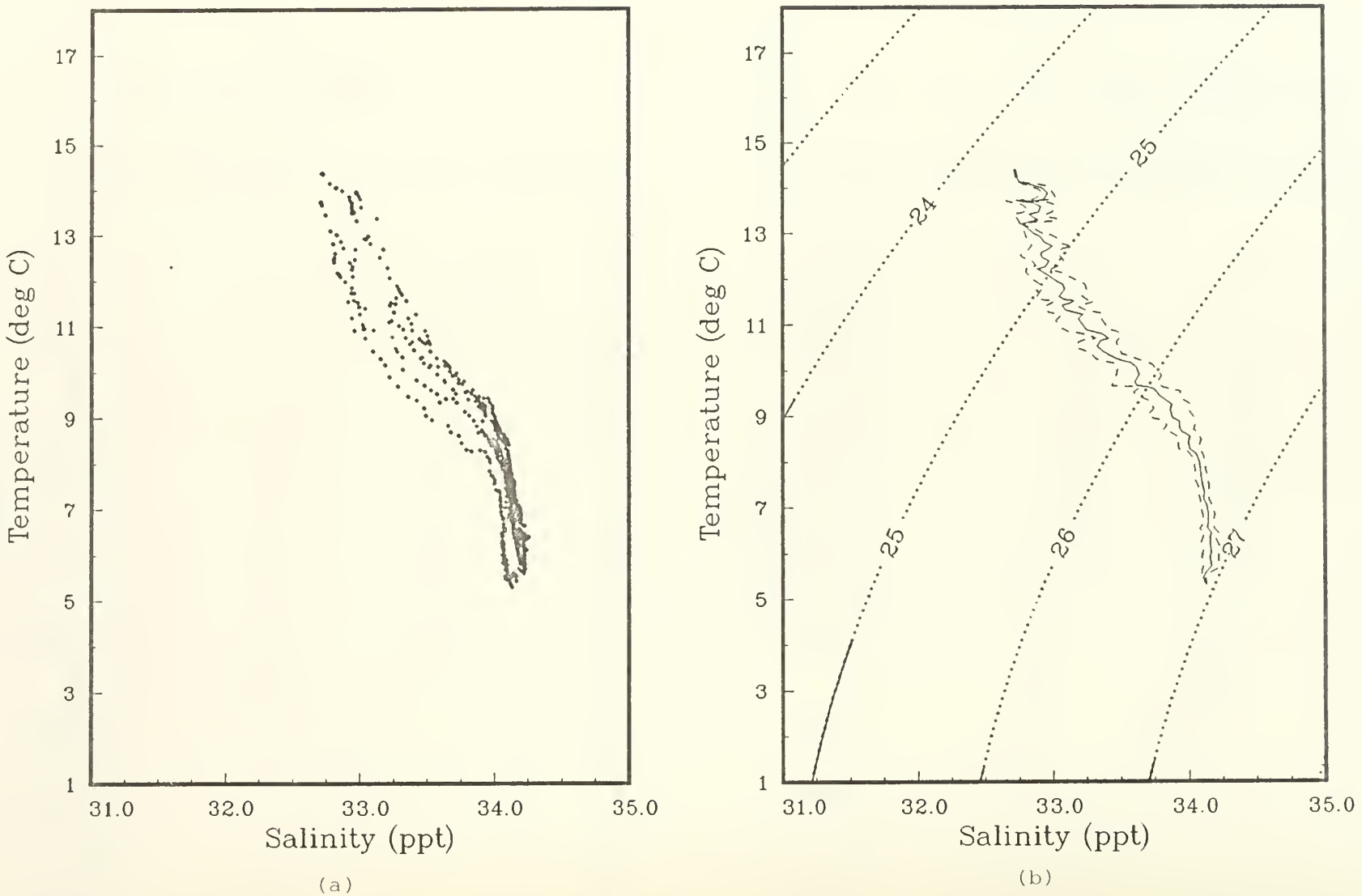


Figure 21: (a) T-S pairs and (b) mean T-S relationship, with + and - the standard deviation, and selected sigma-t contours, from the CTD casts. (OPTOMA5, Leg AI).

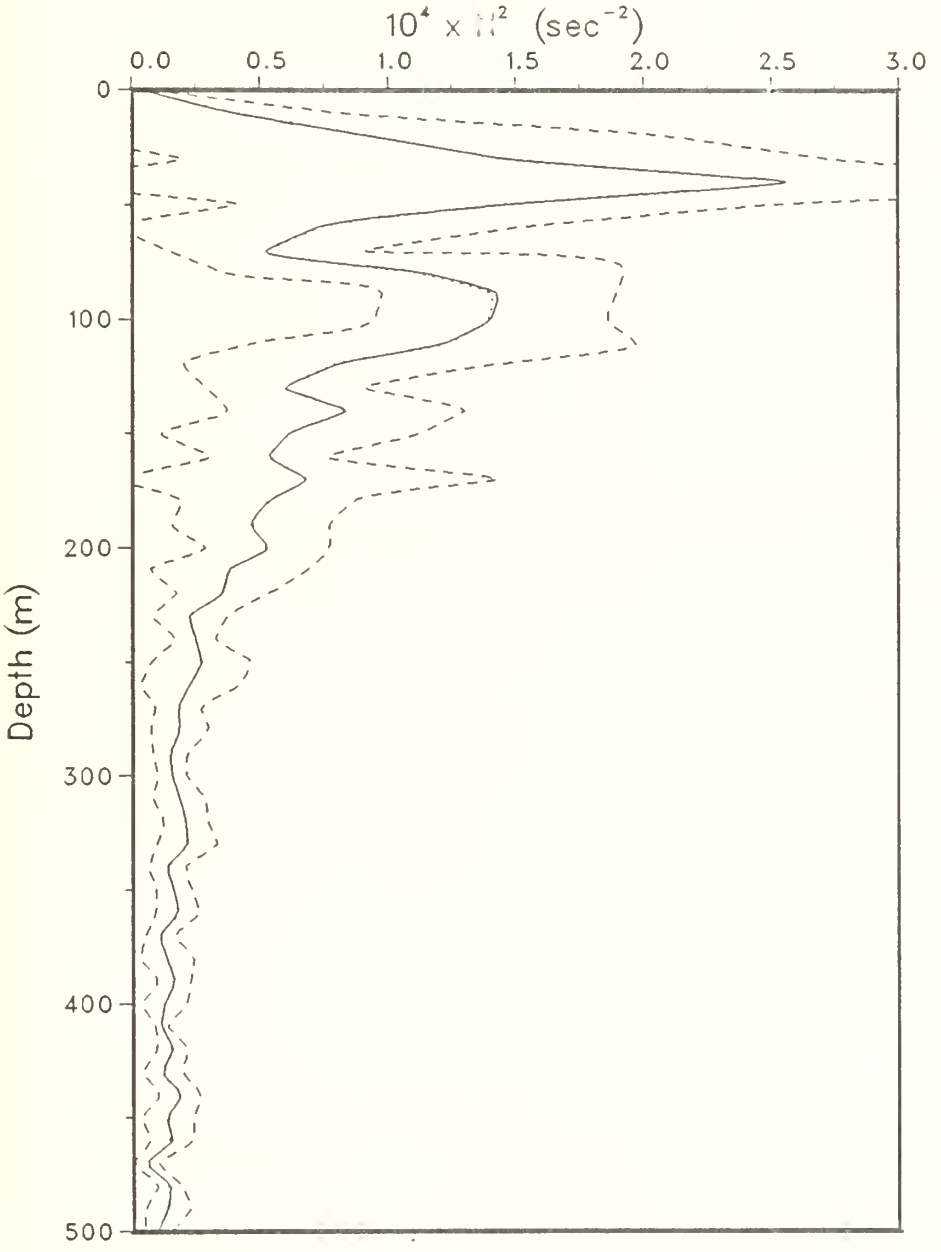


Figure 22: Profile of $\overline{N^2(z)}$ (——), with + and - the standard deviation (----), and the profile of N^2 from $\overline{T(z)}$ and $\overline{S(z)}$ (····). (OPTOMA5, Leg AI).

SECTION 3

OPTOMA5 Leg AII

29 June - 4 July 1983

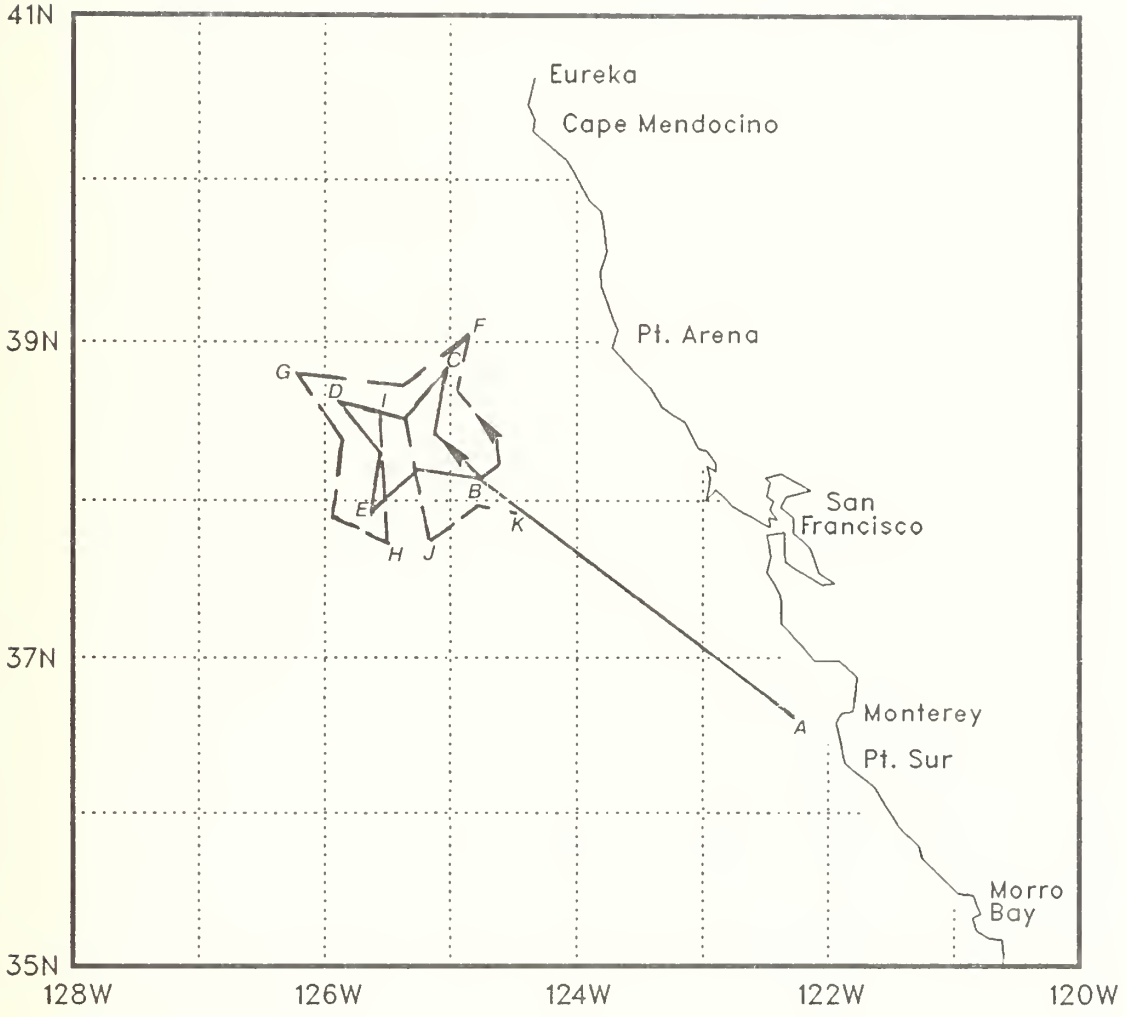


Figure 23: Cruise track for OPTOMA5, Leg AII with transect extremes identified by letter. The track traversed first is drawn with solid lines, the second track is drawn with broken lines.

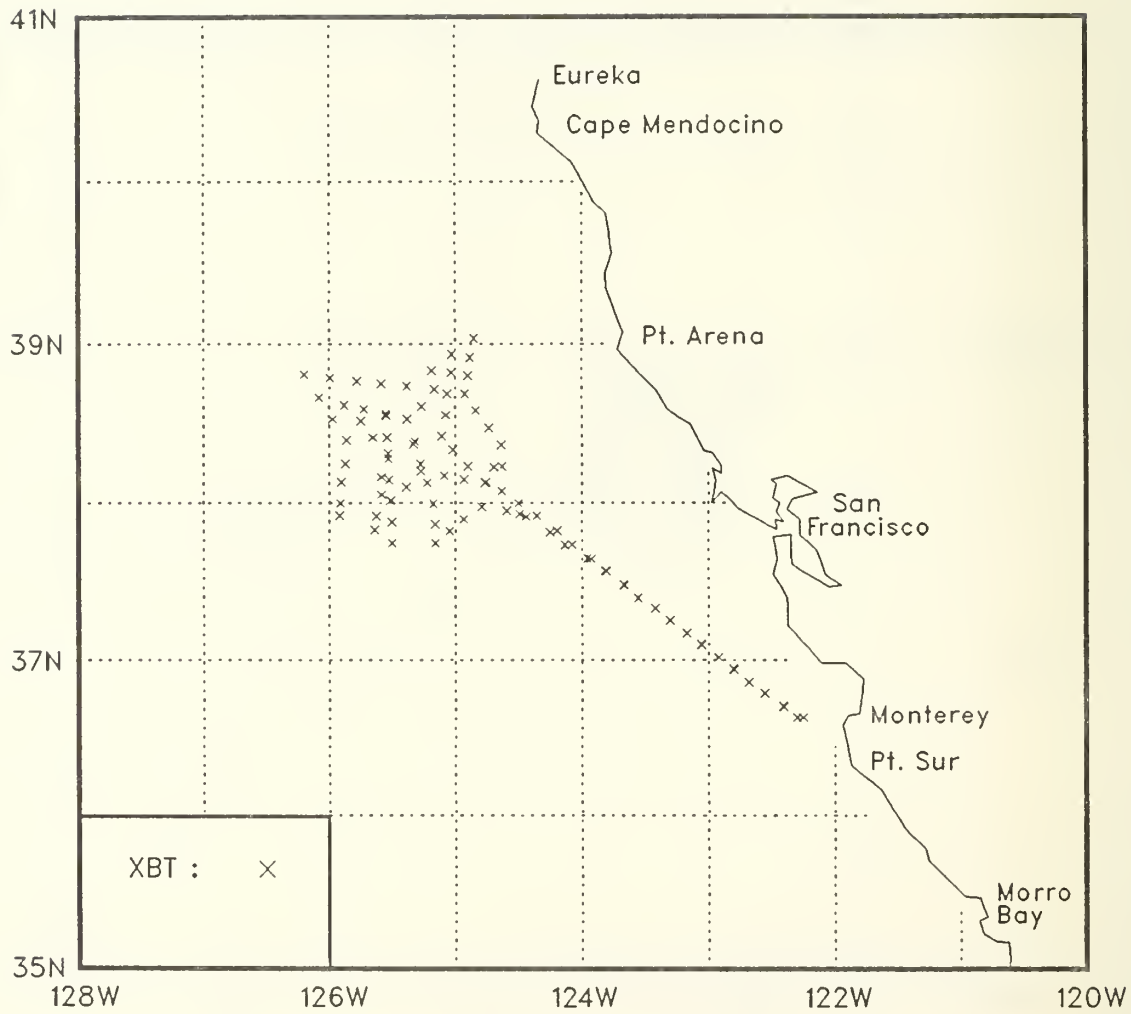


Figure 24: XBT locations for OPTOMA5, Leg AII.

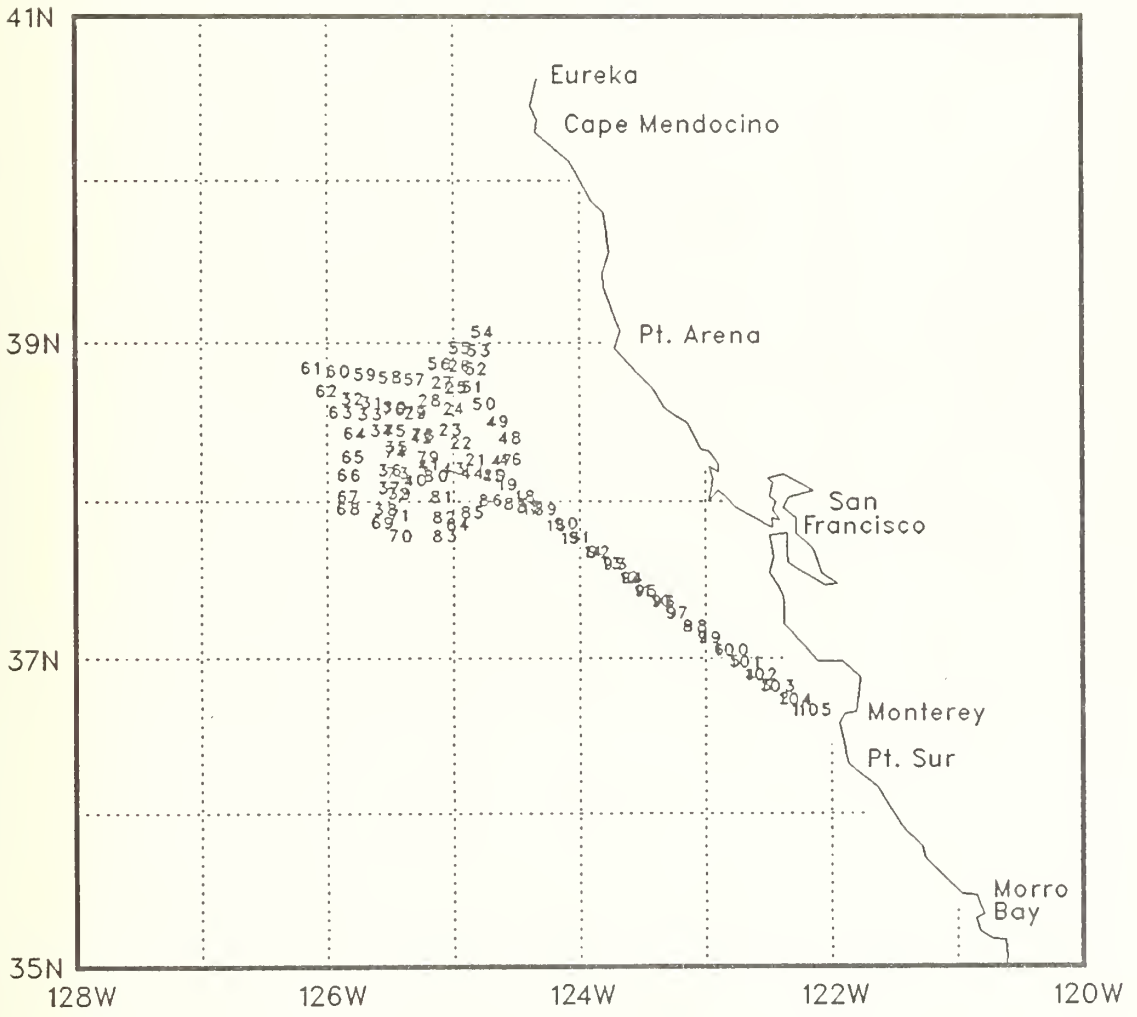


Figure 25: Station numbers for OPTOMA5, Leg AII.

Table 4: Leg AII Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)
1	XBT	83180	1922	36.38	122.18	13.4
2	XBT	83180	2017	36.42	122.24	13.7
3	XBT	83180	2120	36.47	122.33	13.6
4	XBT	83180	2259	36.52	122.41	14.3
5	XBT	83181	132	36.57	122.48	14.8
6	XBT	83181	243	37.01	122.55	14.3
7	XBT	83181	448	37.06	123.03	15.2
8	XBT	83181	610	37.10	123.10	14.3
9	XBT	83181	752	37.16	123.18	13.8
10	XBT	83181	916	37.20	123.25	14.6
11	XBT	83181	1040	37.24	123.33	14.5
12	XBT	83181	1204	37.29	123.40	14.3
13	XBT	83181	1350	37.34	123.49	13.8
14	XBT	83181	1520	37.39	123.57	12.7
15	XBT	83181	1708	37.44	124.08	12.9
16	XBT	83181	1839	37.49	124.15	12.3
17	XBT	83181	2000	37.55	124.26	13.6
18	XBT	83181	2123	38.00	124.30	14.4
19	XBT	83181	2237	38.05	124.38	14.7
20	XBT	83181	2343	38.08	124.46	15.0
21	XBT	83182	112	38.14	124.54	15.0
22	XBT	83182	230	38.20	125.01	14.8
23	XBT	83182	332	38.25	125.07	14.9
24	XBT	83182	438	38.33	125.05	15.5
25	XBT	83182	538	38.41	125.04	15.4
26	XBT	83182	637	38.49	125.02	15.3
27	XBT	83182	741	38.43	125.10	15.6
28	XBT	83182	841	38.36	125.16	15.3
29	XBT	83182	935	38.32	125.23	15.3
30	XBT	83182	1040	38.34	125.33	15.9
31	XBT	83182	1149	38.36	125.43	15.9
32	XBT	83182	1322	38.37	125.53	15.9
33	XBT	83182	1445	38.31	125.45	15.6
34	XBT	83182	1558	38.25	125.39	15.7
35	XBT	83182	1709	38.19	125.32	15.2
36	XBT	83182	1834	38.10	125.35	14.7
37	XBT	83182	1959	38.03	125.35	15.1
38	XBT	83182	2137	37.55	125.37	15.2
39	XBT	83182	2236	38.01	125.31	14.9
40	XBT	83182	2332	38.06	125.23	15.1
41	XBT	83183	34	38.12	125.16	15.2
42	XBT	83183	150	38.23	125.20	15.1
43	XBT	83183	351	38.11	125.05	15.2
44	XBT	83183	454	38.09	124.56	15.1
45	XBT	83183	556	38.08	124.46	15.2

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)
46	XBT	83183	706	38.14	124.38	15.3
47	XBT	83183	723	38.14	124.42	15.3
48	XBT	83183	807	38.22	124.38	15.4
49	XBT	83183	903	38.28	124.44	15.6
50	XBT	83183	1006	38.35	124.50	15.4
51	XBT	83183	1104	38.41	124.56	15.4
52	XBT	83183	1157	38.48	124.54	15.6
53	XBT	83183	1250	38.55	124.53	15.3
54	XBT	83183	1349	39.02	124.51	15.4
55	XBT	83183	1512	38.56	125.02	15.9
56	XBT	83183	1622	38.50	125.12	16.2
57	XBT	83183	1738	38.44	125.23	15.9
58	XBT	83183	1846	38.45	125.35	15.8
59	XBT	83183	1953	38.46	125.47	16.1
60	XBT	83183	2108	38.47	126.00	16.0
61	XBT	83183	2219	38.49	126.12	16.3
62	XBT	83183	2329	38.40	126.05	16.1
63	XBT	83184	35	38.32	125.58	16.1
64	XBT	83184	142	38.24	125.52	16.0
65	XBT	83184	242	38.15	125.52	15.3
66	XBT	83184	330	38.08	125.54	15.1
67	XBT	83184	426	38.00	125.55	15.0
68	XBT	83184	528	37.55	125.55	14.8
69	XBT	83184	628	37.50	125.38	15.0
70	XBT	83184	723	37.45	125.30	15.4
71	XBT	83184	828	37.53	125.30	15.2
72	XBT	83184	926	38.01	125.31	14.9
73	XBT	83184	1034	38.09	125.32	15.1
74	XBT	83184	1139	38.17	125.32	15.4
75	XBT	83184	1242	38.25	125.32	15.2
76	XBT	83184	1346	38.33	125.33	16.2
77	XBT	83184	1444	38.32	125.23	15.7
78	XBT	83184	1547	38.23	125.19	15.2
79	XBT	83184	1652	38.15	125.17	15.2
80	XBT	83184	1748	38.08	125.14	15.1
81	XBT	83184	1853	38.00	125.11	15.1
82	XBT	83184	1951	37.52	125.10	14.8
83	XBT	83184	2041	37.45	125.10	15.2
84	XBT	83184	2137	37.49	125.03	14.5
85	XBT	83184	2236	37.54	124.56	14.7
86	XBT	83184	2344	37.59	124.47	15.4
87	XBT	83185	105	37.57	124.35	15.3
88	XBT	83185	146	37.56	124.29	14.5
89	XBT	83185	237	37.55	124.21	13.9
90	XBT	83185	345	37.50	124.12	14.0

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)
91	XBT	83185	437	37.44	124.04	14.4
92	XBT	83185	539	37.39	123.56	14.2
93	XBT	83185	640	37.34	123.48	13.5
94	XBT	83185	736	37.29	123.40	14.0
95	XBT	83185	825	37.24	123.33	14.1
96	XBT	83185	919	37.20	123.25	14.2
97	XBT	83185	1018	37.15	123.18	13.9
98	XBT	83185	1122	37.10	123.10	13.9
99	XBT	83185	1218	37.06	123.03	14.2
100	XBT	83185	1322	37.01	122.55	14.9
101	XBT	83185	1415	36.57	122.48	14.2
102	XBT	83185	1506	36.52	122.40	14.3
103	XBT	83185	1559	36.47	122.33	13.9
104	XBT	83185	1654	36.42	122.24	13.7
105	XBT	83185	1743	36.38	122.15	14.0

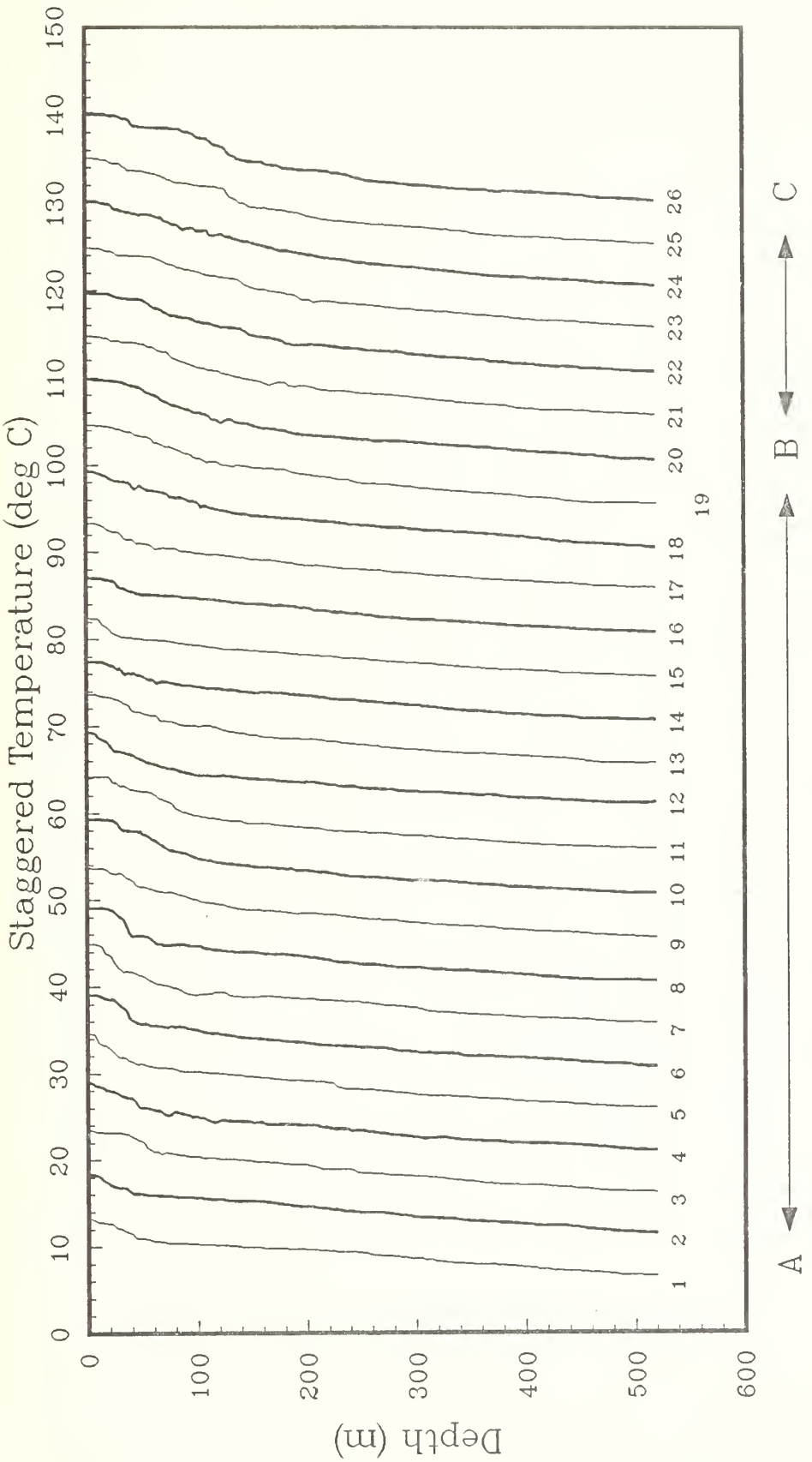


Figure 26(a): Staggered temperature profiles from the XBT's. Profiles are staggered by a multiple of 5C. (OPTOMA5, Leg AII).

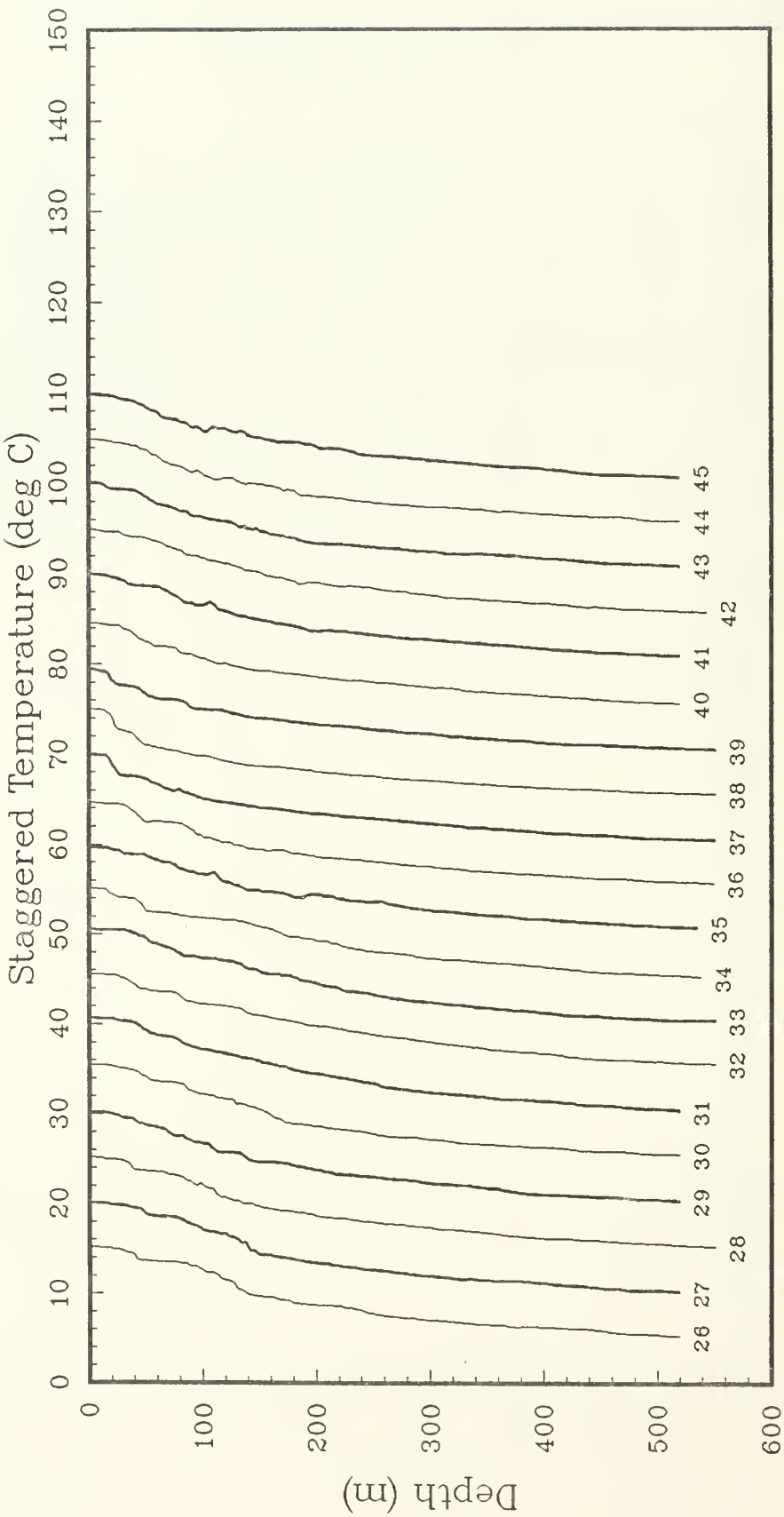

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Depth (m)
0
100
200
300
400
500
600
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
C
D
E
B

Figure 26(b)

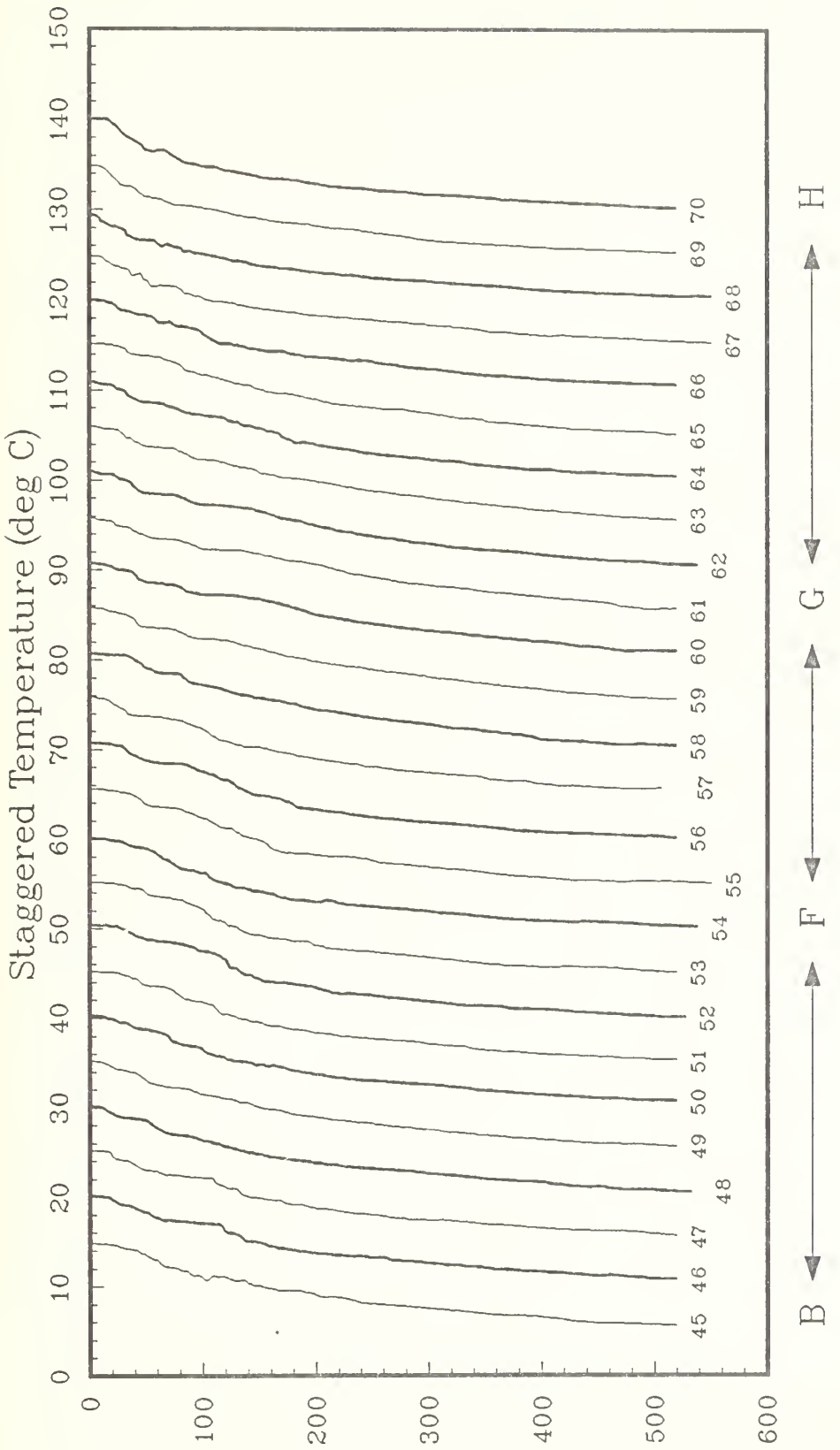
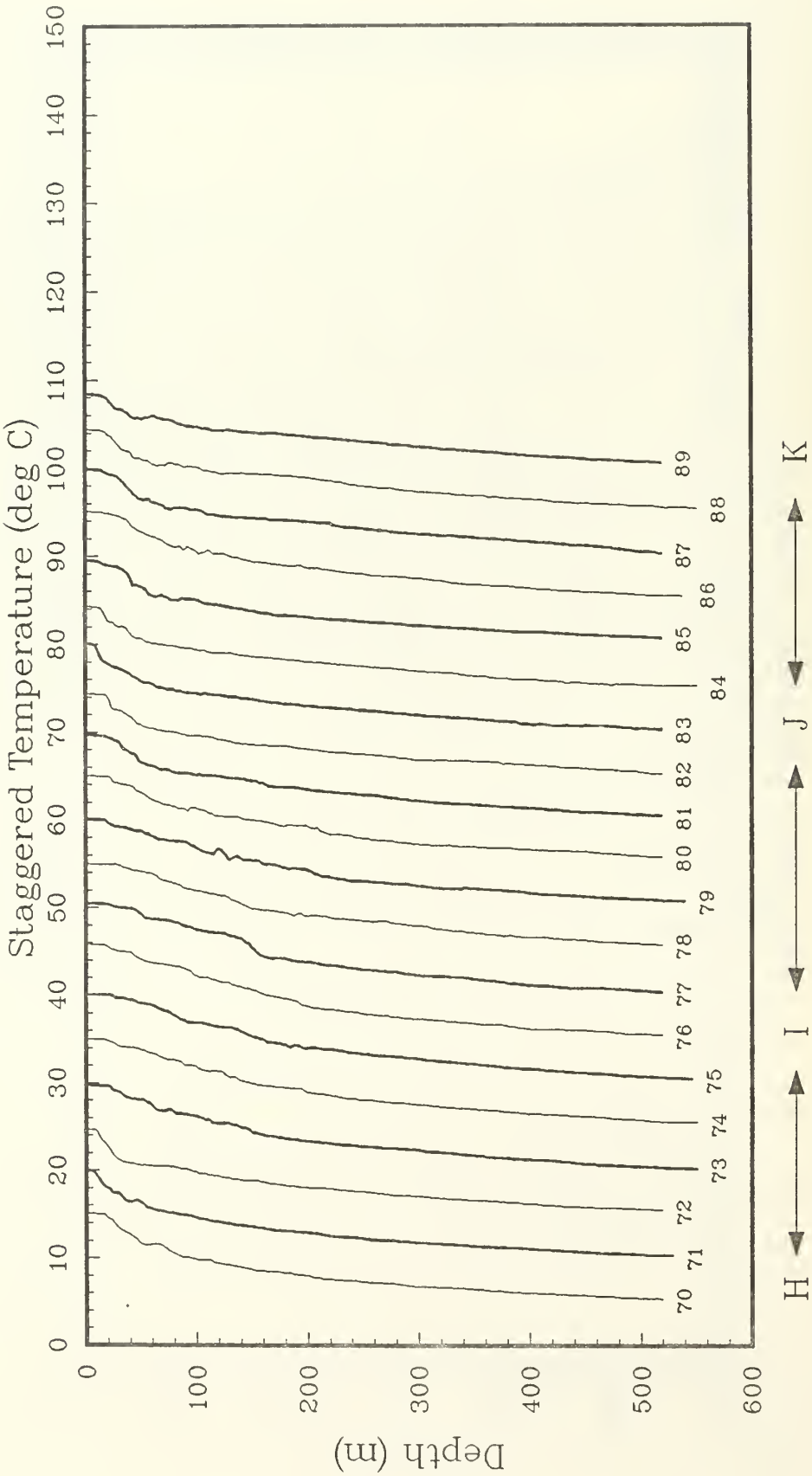

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Depth (m)
0
100
200
300
400
500
600
45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70
B
F
G
H

Figure 26(c)


Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Depth (m)
0
100
200
300
400
500
600
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
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88
89
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I
J
K

Fgiure 26(d)

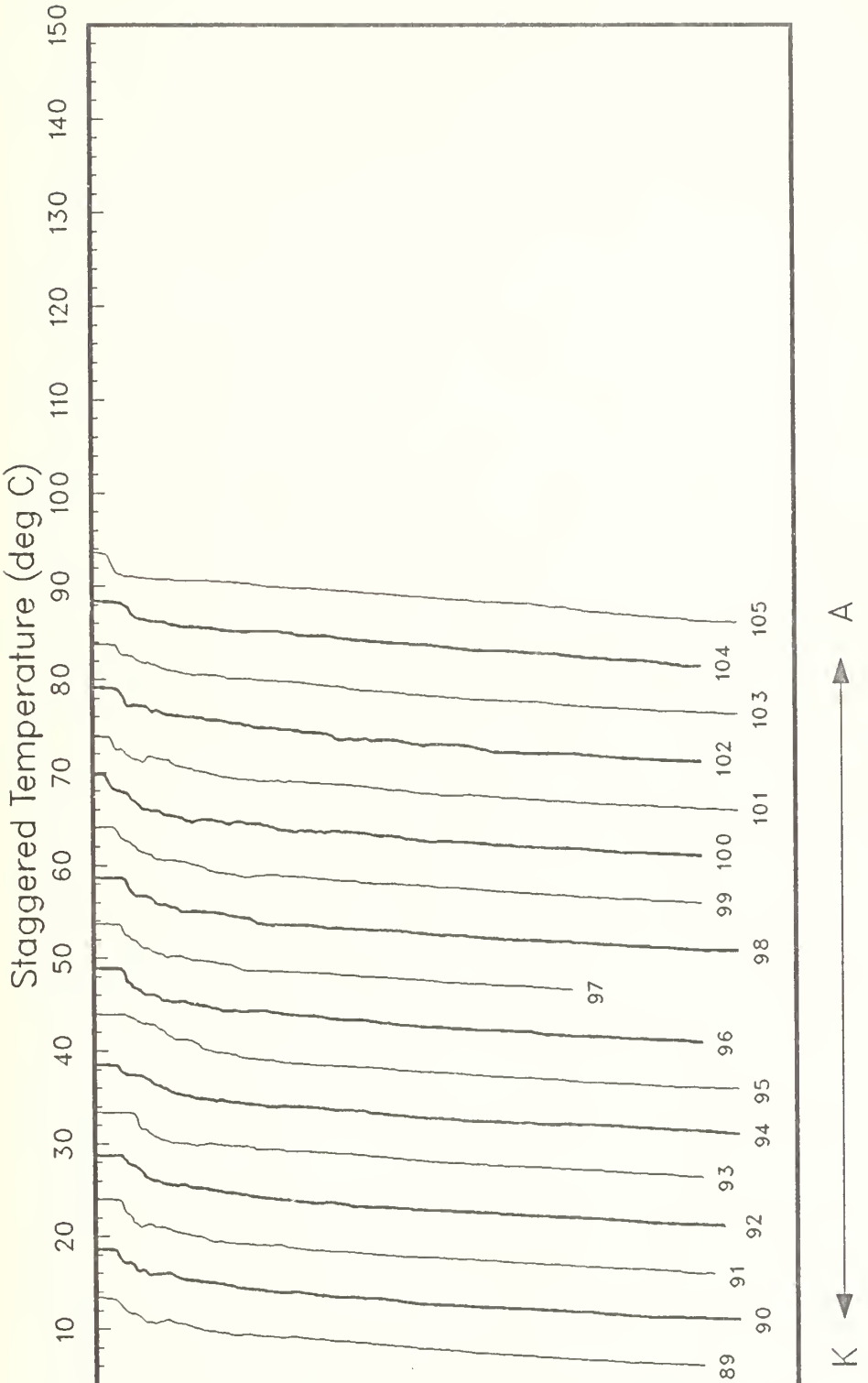
Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Depth (m)
0
100
200
300
400
500
600
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
K
A

Figure 26(e)

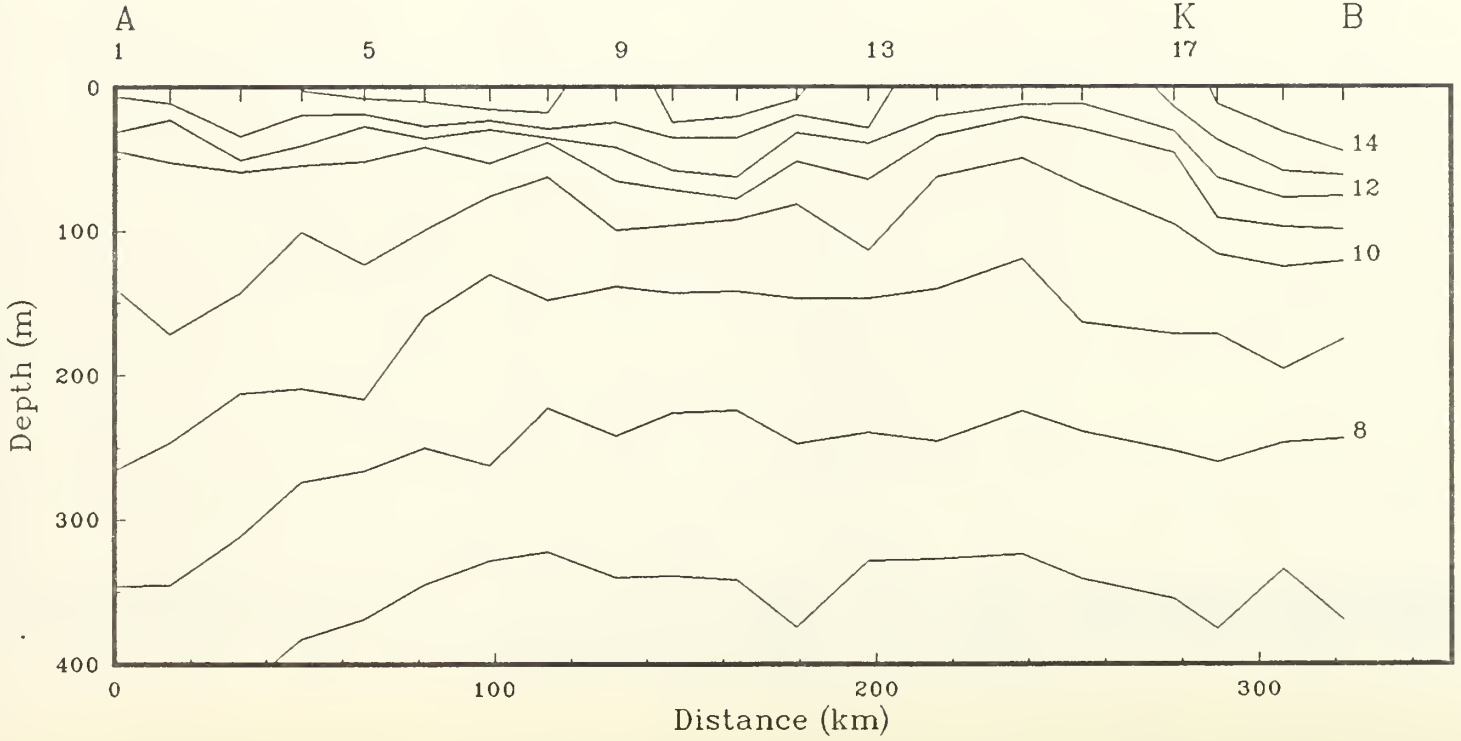

Figure 27(a): Isotherms from XBT's. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. (OPTOMA5, Leg AII).

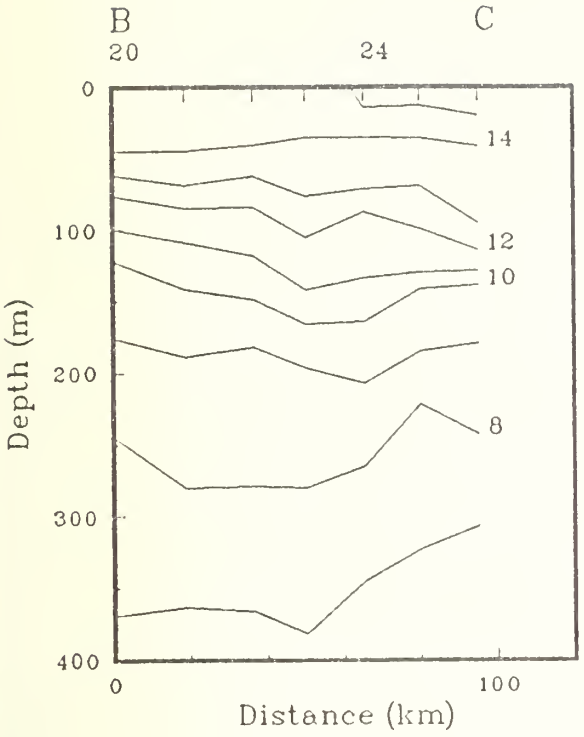

Figure 27(b)

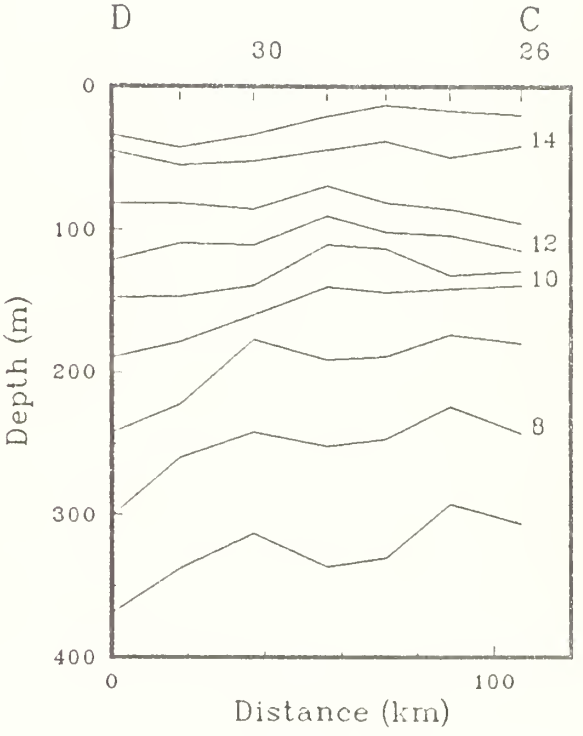

Figure 27(c)

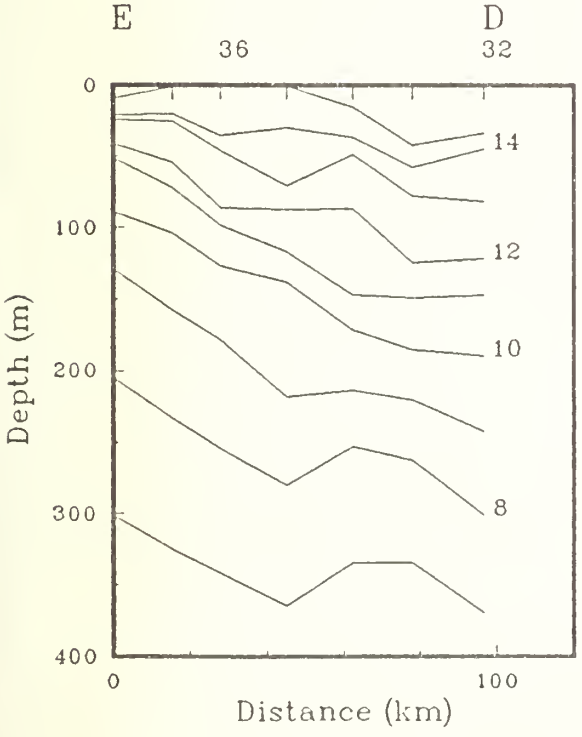

Figure 27(d)

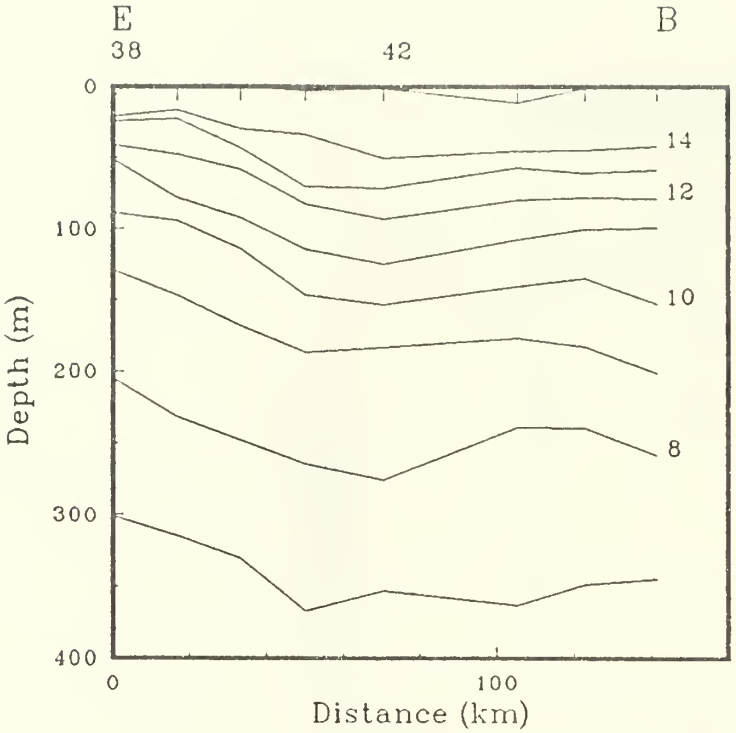

Figure 27(e)

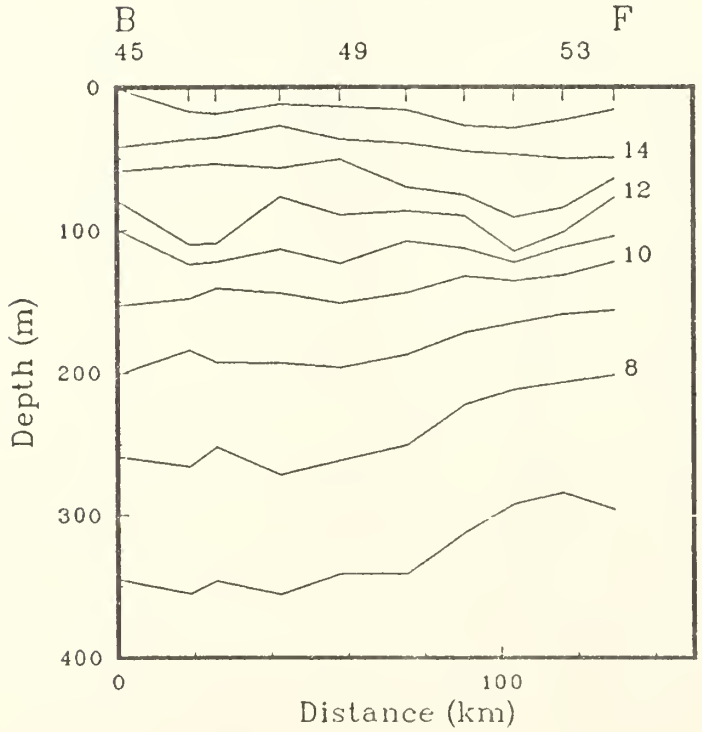

Figure 27(f)

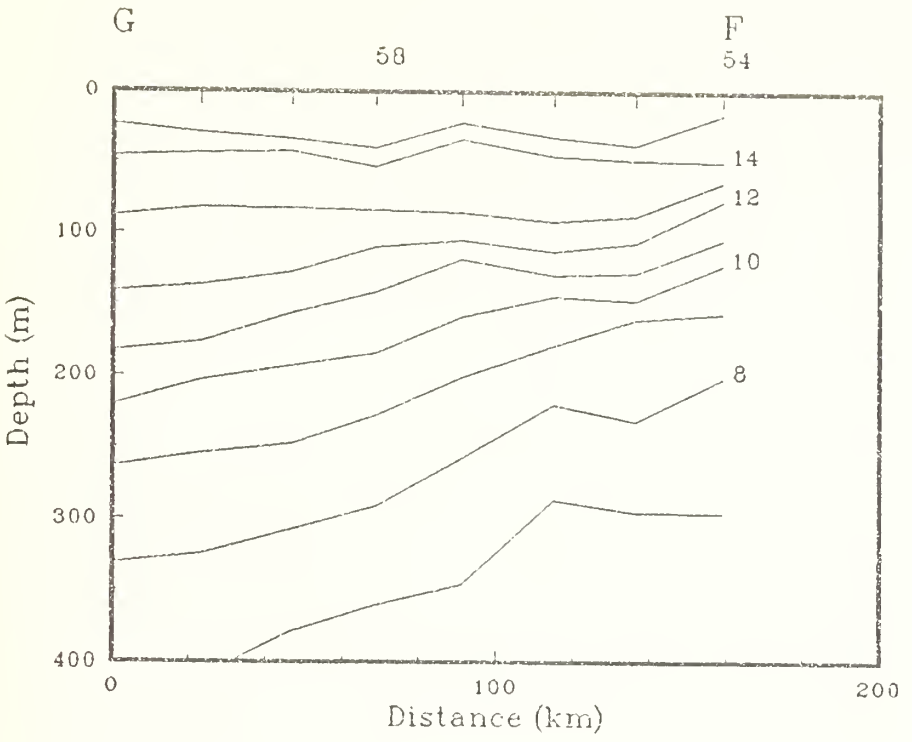

Figure 27(g)

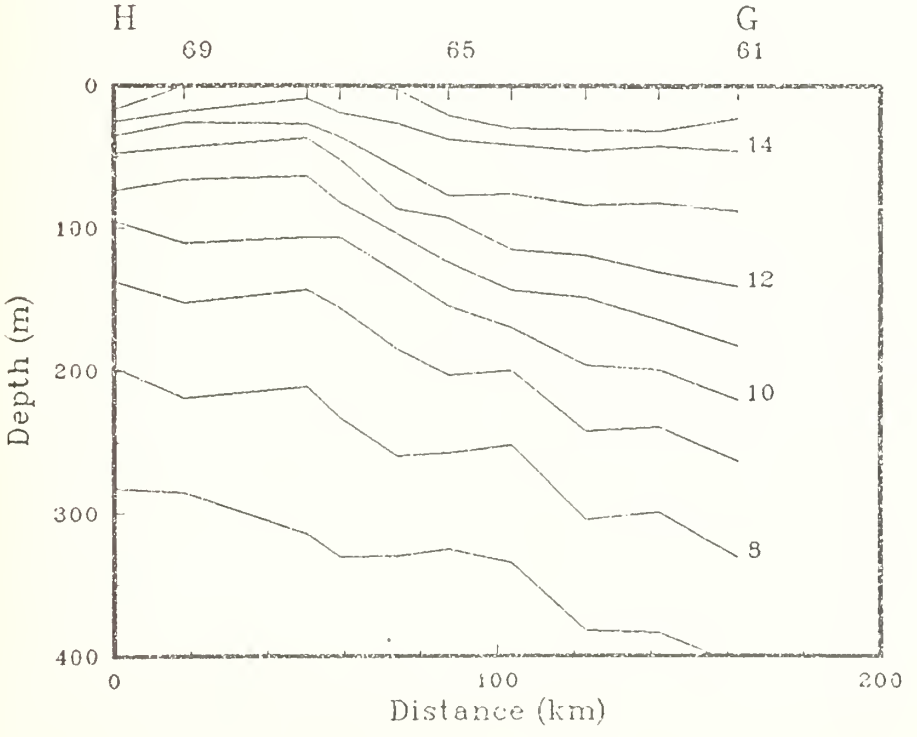

Figure 27(h)

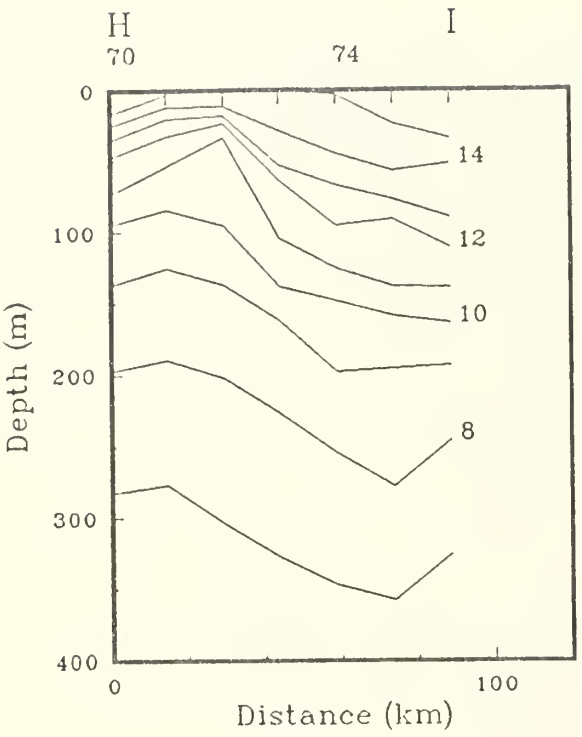

Figure 27(i)

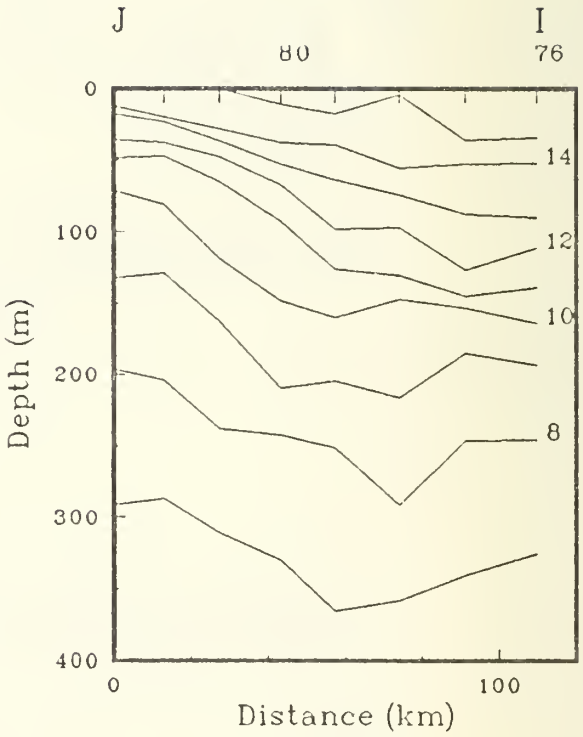

Figure 27(j)

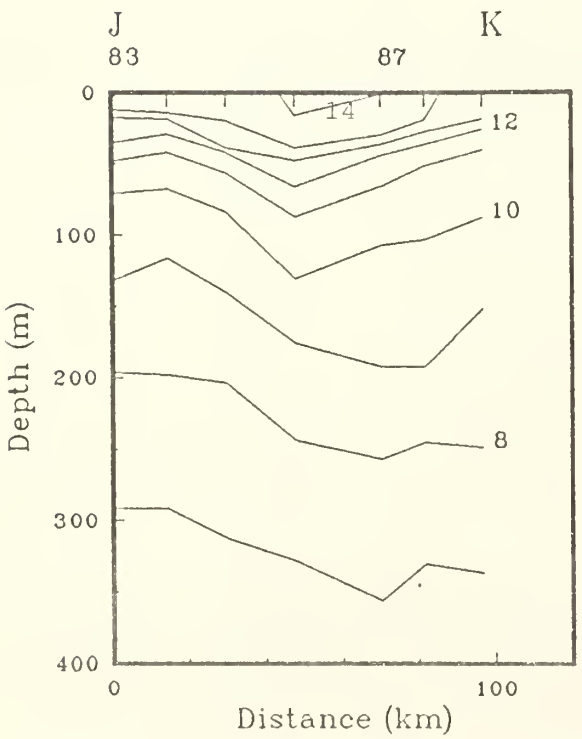

Figure 27(k)

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SECTION 4

OPTOMA5 Leg AIII

13 - 20 July 1983

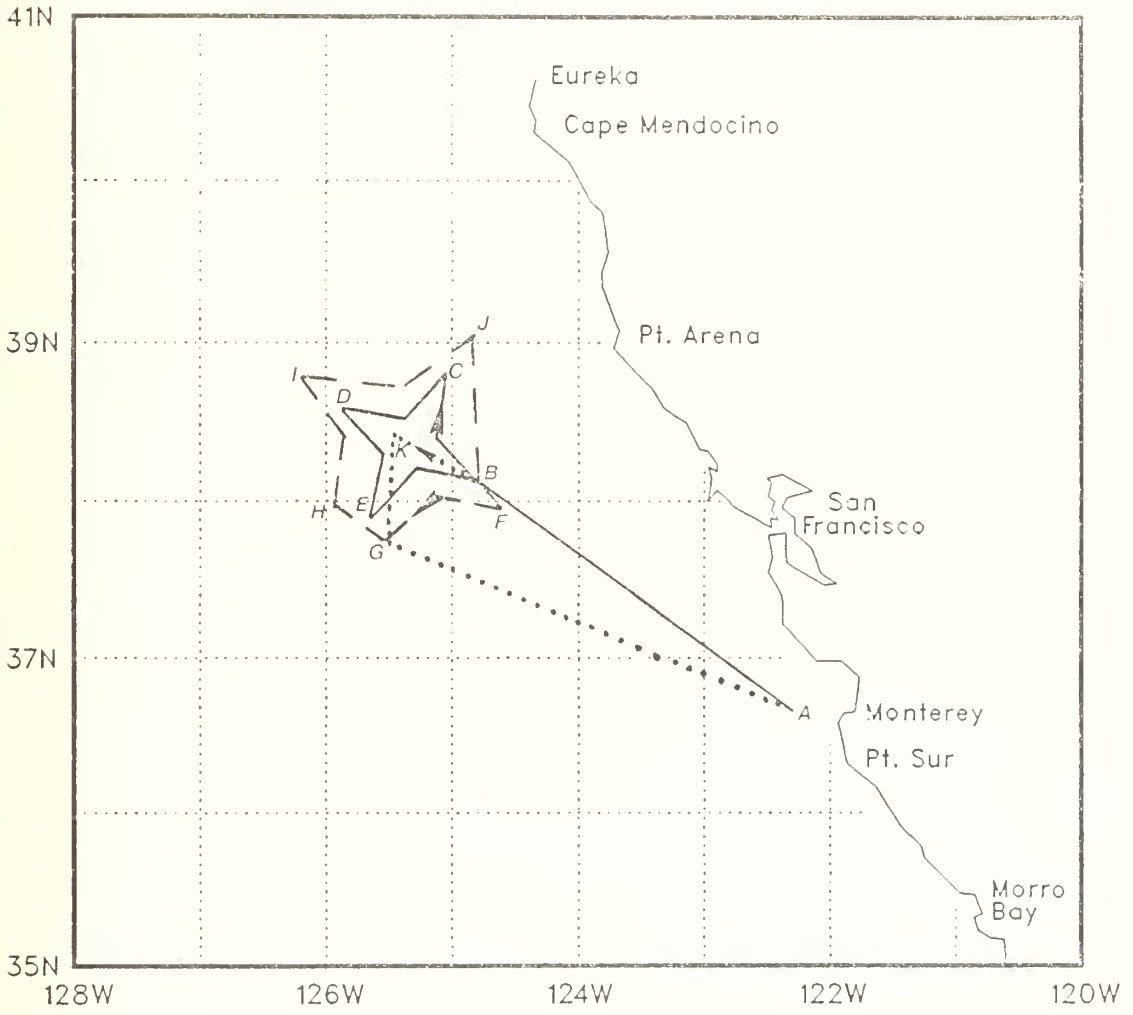


Figure 29: Cruise track for OPTOMA5, Leg AIII with transect extremes identified by letter. The solid track was traversed first, followed by the broken track and then the dotted track.

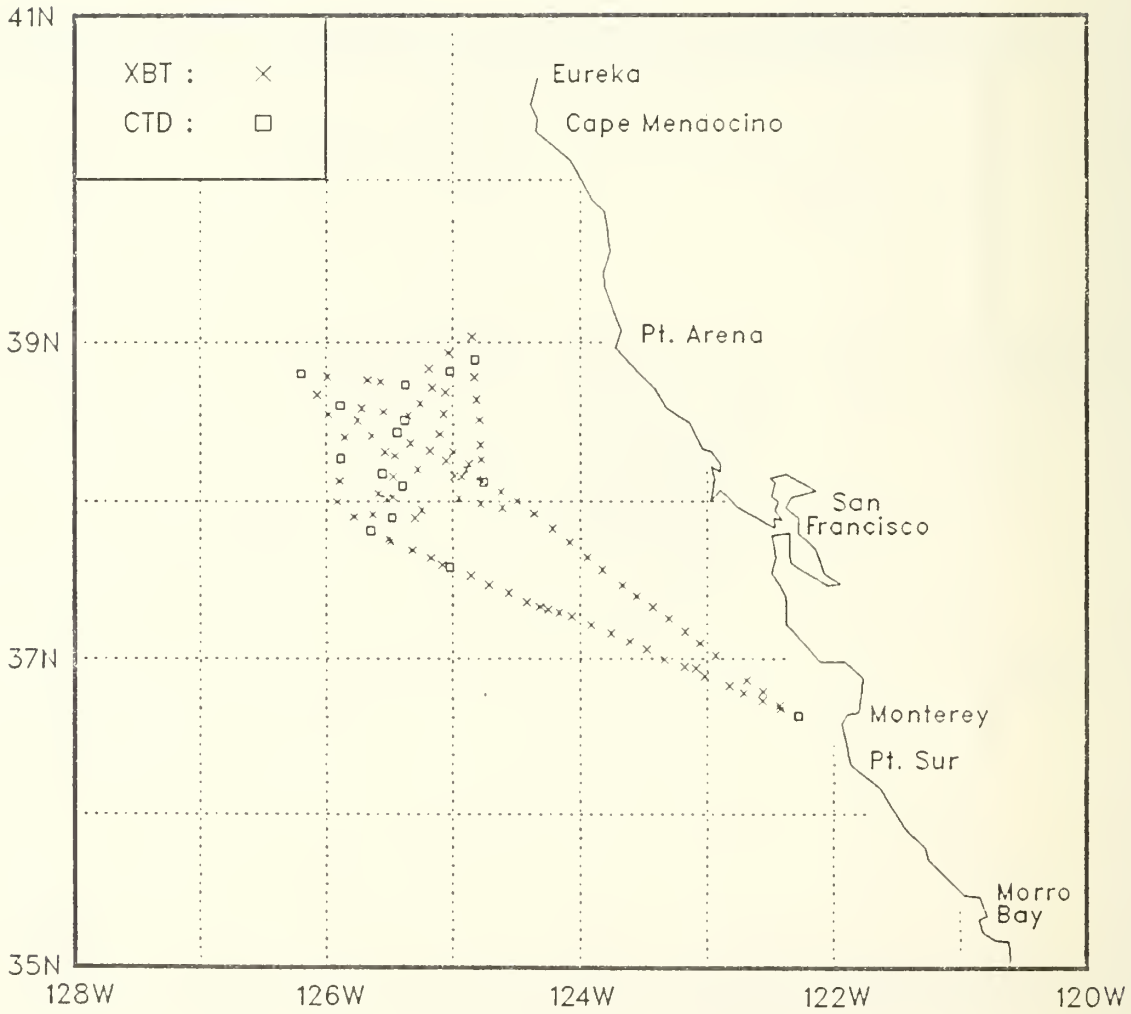


Figure 30: XBT and CTD locations for OPTOMA5, Leg AIII.

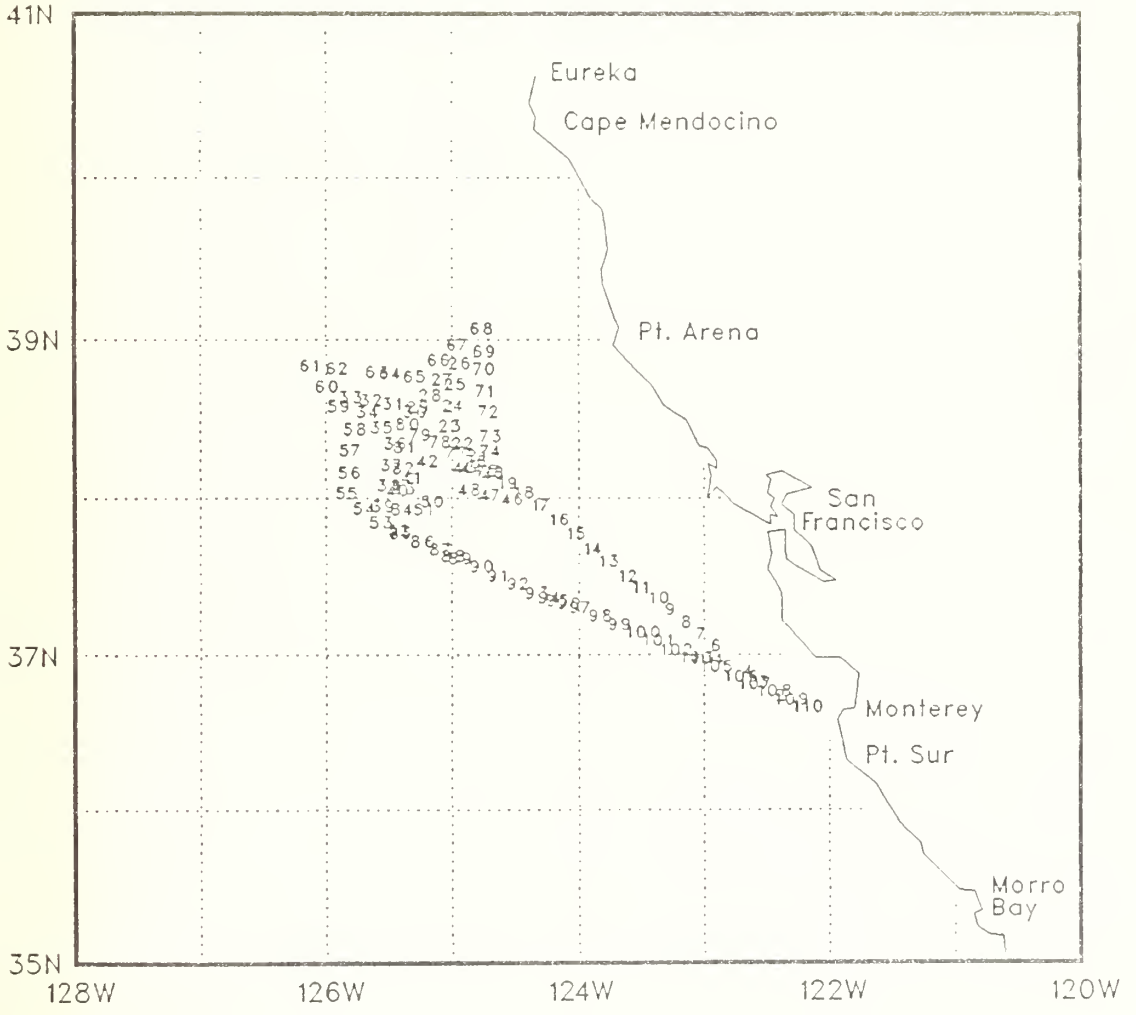


Figure 31: Station numbers for OPTOMA5, Leg AIII.

Table 5: Leg AIII Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
1	CTD	83194	1933	36.38	122.17	13.3	33.49	13.4	33.47
2	XBT	83194	2130	36.42	122.25	14.2			
3	XBT	83194	2235	36.48	122.33	14.9			
4	XBT	83194	2335	36.52	122.41	15.1			
6	XBT	83195	257	37.02	122.56	13.9			
7	XBT	83195	425	37.06	123.03	15.0			
8	XBT	83195	600	37.11	123.10	15.0			
9	XBT	83195	821	37.16	123.18	15.2			
10	XBT	83195	1024	37.20	123.25	15.0			
11	XBT	83195	1245	37.24	123.33	14.3			
12	XBT	83195	1711	37.28	123.40	14.7			
13	XBT	83195	2110	37.34	123.49	12.1			
14	XBT	83196	46	37.39	123.57	12.8			
15	XBT	83196	539	37.45	124.05	12.8			
16	XBT	83196	1011	37.50	124.13	12.9			
17	XBT	83196	1439	37.56	124.21	13.1			
18	XBT	83196	1734	38.00	124.30	12.5			
19	XBT	83196	2032	38.04	124.37	11.8			
20	XBT	83197	34	38.08	124.46	13.0			
21	XBT	83197	611	38.14	124.52	13.1			
22	XBT	83197	952	38.19	125.00	14.0			
23	XBT	83197	1344	38.26	125.06	14.9			
24	XBT	83197	1637	38.33	125.04	15.1			
25	XBT	83197	1908	38.41	125.04	15.0			
26	CTD	83197	2116	38.49	125.01	15.3	32.71	15.4	32.74
27	XBT	83197	2338	38.43	125.10	15.0			
28	XBT	83198	41	38.37	125.15	14.9			
29	XBT	83198	142	38.33	125.21	15.5			
30	CTD	83198	203	38.31	125.23	15.7	32.81	15.9	32.83
31	XBT	83198	412	38.34	125.33	15.8			
32	XBT	83198	525	38.35	125.43	15.6			
33	CTD	83198	642	38.36	125.53	15.9	32.97	15.7	32.96
34	XBT	83198	831	38.31	125.45	15.7			
35	XBT	83198	927	38.25	125.38	15.4			
36	XBT	83198	1025	38.19	125.32	15.6			
37	CTD	83198	1203	38.11	125.34	15.1	32.80	15.9	32.78
38	XBT	83198	1318	38.03	125.35	15.2			
39	XBT	83198	1423	37.55	125.38	15.1			
40	XBT	83198	1530	38.01	125.31	15.5			
41	CTD	83198	1636	38.06	125.24	15.3	32.79		
42	XBT	83198	1822	38.12	125.17	15.6			
43	XBT	83198	2000	38.10	124.59	14.3			
44	XBT	83198	2024	38.10	124.56	14.6			
45	CTD	83198	2123	38.07	124.45	14.5	32.79	13.8	32.26
46	XBT	83198	2333	37.58	124.37	13.9			

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
47	XBT	83199	34	37.59	124.47	12.3			
48	XBT	83199	133	38.01	124.57	14.7			
50	XBT	83199	404	37.57	125.15	15.7			
51	XBT	83199	451	37.54	125.18	15.4			
52	XBT	83199	546	37.46	125.30	13.8			
53	CTD	83199	646	37.49	125.39	14.5	32.84	14.6	32.82
54	XBT	83199	822	37.54	125.47	14.3			
55	XBT	83199	919	38.00	125.55	15.6			
56	XBT	83199	1016	38.08	125.54	15.0			
57	CTD	83199	1120	38.16	125.53	15.4	32.80	15.4	32.82
58	XBT	83199	1305	38.24	125.51	15.7			
59	XBT	83199	1425	38.33	125.59	15.9			
60	XBT	83199	1531	38.40	126.05	15.8			
61	CTD	83199	1655	38.48	126.12	16.0	32.98	16.2	32.97
62	XBT	83199	1845	38.47	125.59	15.9			
63	XBT	83199	2027	38.46	125.41	16.3			
64	XBT	83199	2102	38.45	125.34	16.3			
65	CTD	83199	2207	38.44	125.22	16.2	32.80	16.5	32.79
66	XBT	83200	32	38.50	125.11	16.1			
67	XBT	83200	143	38.56	125.02	16.2			
68	XBT	83200	255	39.02	124.51	16.1			
69	CTD	83200	418	38.54	124.49	16.1	32.85	16.1	32.82
70	XBT	83200	518	38.47	124.50	16.1			
71	XBT	83200	611	38.39	124.49	16.1			
72	XBT	83200	701	38.31	124.48	15.9			
73	XBT	83200	826	38.22	124.47	16.1			
74	XBT	83200	906	38.16	124.46	15.8			
75	XBT	83200	1013	38.09	124.48	15.6			
76	XBT	83200	1053	38.12	124.54	16.1			
77	XBT	83200	1148	38.16	125.03	15.8			
78	XBT	83200	1240	38.19	125.11	16.0			
79	XBT	83200	1335	38.22	125.20	15.8			
80	CTD	83200	1428	38.26	125.26	15.8	32.81	15.7	32.79
81	XBT	83200	1611	38.18	125.27	15.8			
82	XBT	83200	1711	38.10	125.28	15.4			
83	XBT	83200	1804	38.02	125.29	15.5			
84	CTD	83200	1900	37.54	125.29	14.7	32.84	15.9	32.84
85	XBT	83200	2036	37.45	125.30	14.0			
86	XBT	83200	2139	37.42	125.19	15.2			
87	XBT	83200	2232	37.39	125.10	15.3			
88	XBT	83200	2310	37.36	125.05	14.9			
89	CTD	83200	2328	37.35	125.01	14.5	32.91	14.7	32.84
90	XBT	83201	56	37.32	124.51	14.4			
91	XBT	83201	149	37.29	124.43	14.9			
92	XBT	83201	245	37.26	124.34	15.0			

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
93	XBT	83201	340	37.22	124.25	14.3			
94	XBT	83201	410	37.20	124.19	15.3			
95	XBT	83201	433	37.19	124.15	15.2			
96	XBT	83201	501	37.18	124.10	15.1			
97	XBT	83201	534	37.16	124.04	15.4			
98	XBT	83201	631	37.13	123.55	16.0			
99	XBT	83201	723	37.10	123.45	16.0			
100	XBT	83201	821	37.07	123.36	15.8			
101	XBT	83201	916	37.04	123.28	16.3			
102	XBT	83201	1008	37.00	123.20	15.2			
103	XBT	83201	1106	36.57	123.10	15.2			
104	XBT	83201	1135	36.57	123.05	14.6			
105	XBT	83201	1207	36.54	123.01	14.3			
106	XBT	83201	1316	36.50	122.49	14.6			
107	XBT	83201	1406	36.47	122.42	15.3			
108	XBT	83201	1500	36.44	122.33	14.4			
109	XBT	83201	1552	36.41	122.25	14.3			
110	CTD	83201	1650	36.38	122.16	14.6			

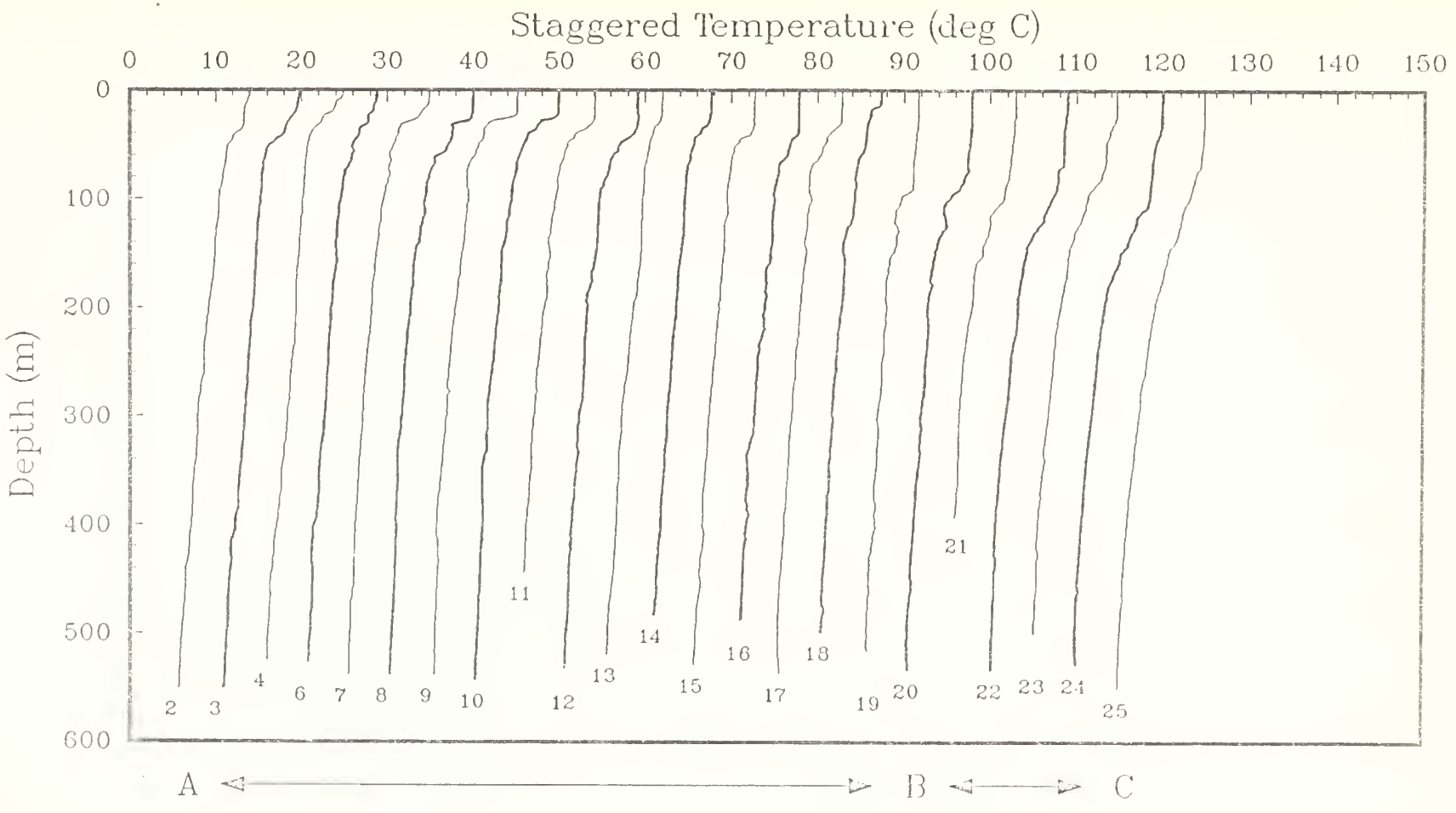


Figure 2.1(a): Staggered temperature profiles from the XBT's. Profiles are staggered by a multiple of 5°. (OPTOMAS, Leg AIII).

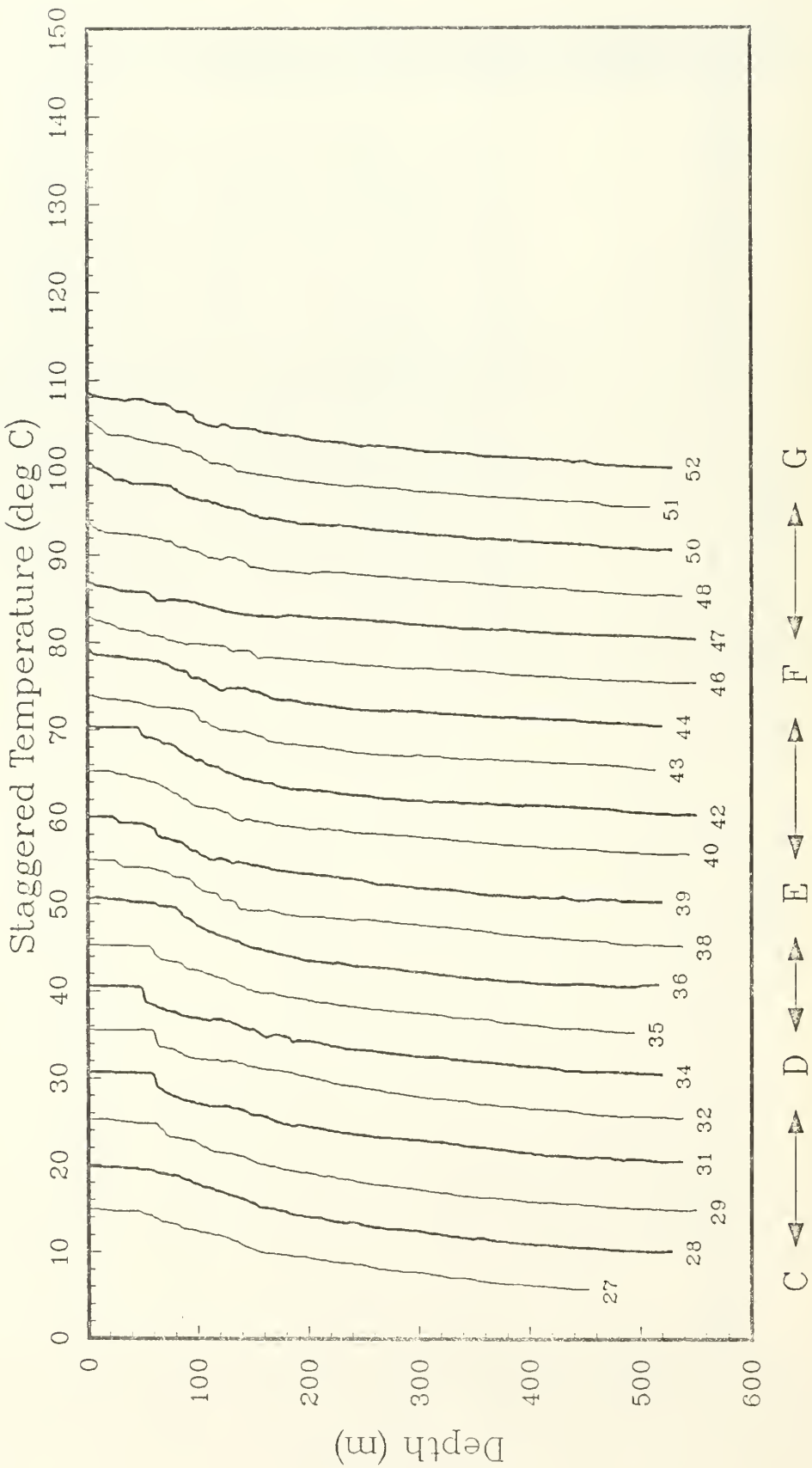

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Depth (m)
0
100
200
300
400
500
600
27
28
29
31
32
34
35
36
38
39
40
42
43
44
46
47
48
50
51
52
C
D
E
F
G

Figure 32(b)

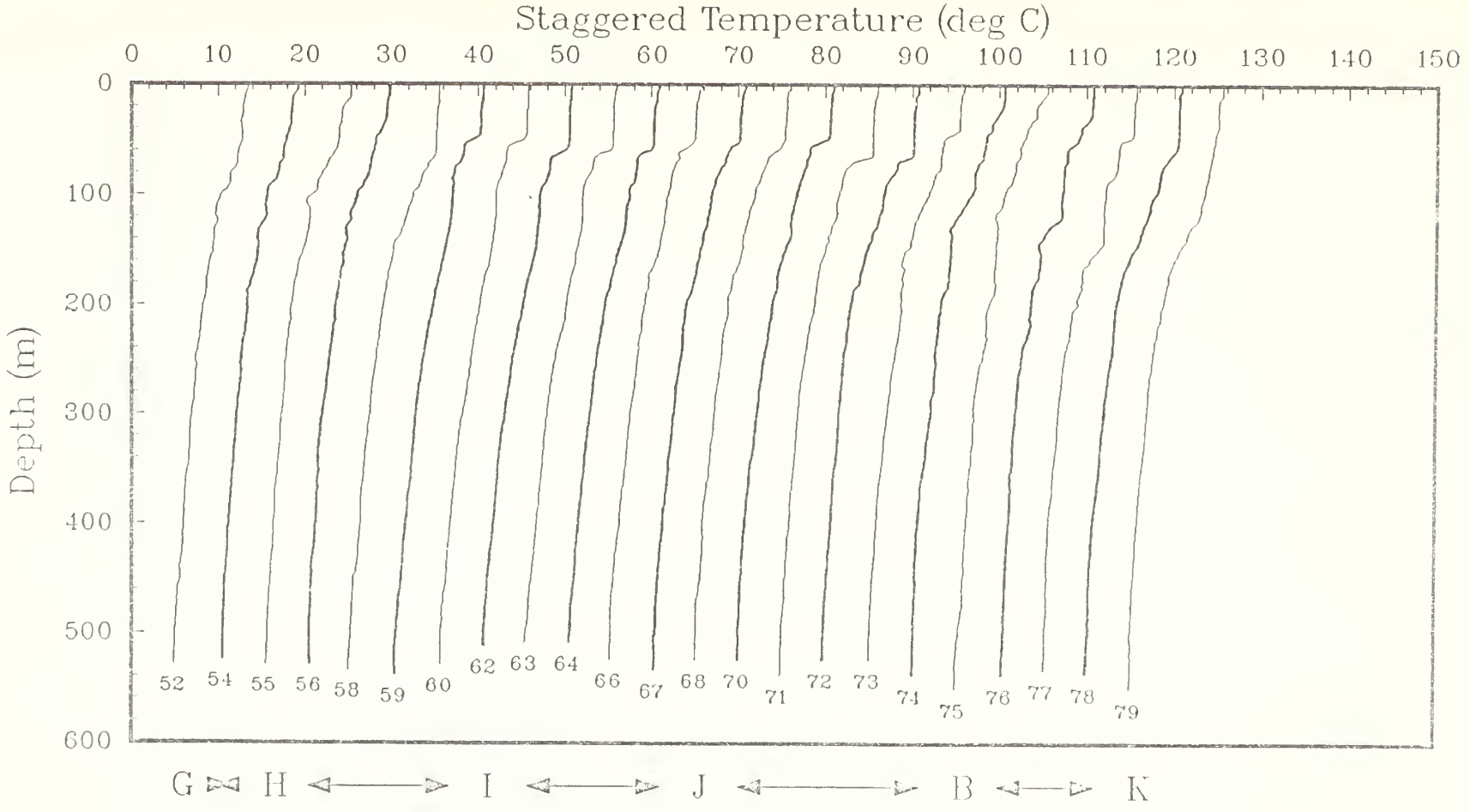

Staggered Temperature (deg C)
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Depth (m)
0 100 200 300 400 500 600
52 54 55 56 58 59 60 62 63 64 66 67 68 70 71 72 73 74 75 76 77 78 79
G H I J B K

Figure 32(c)

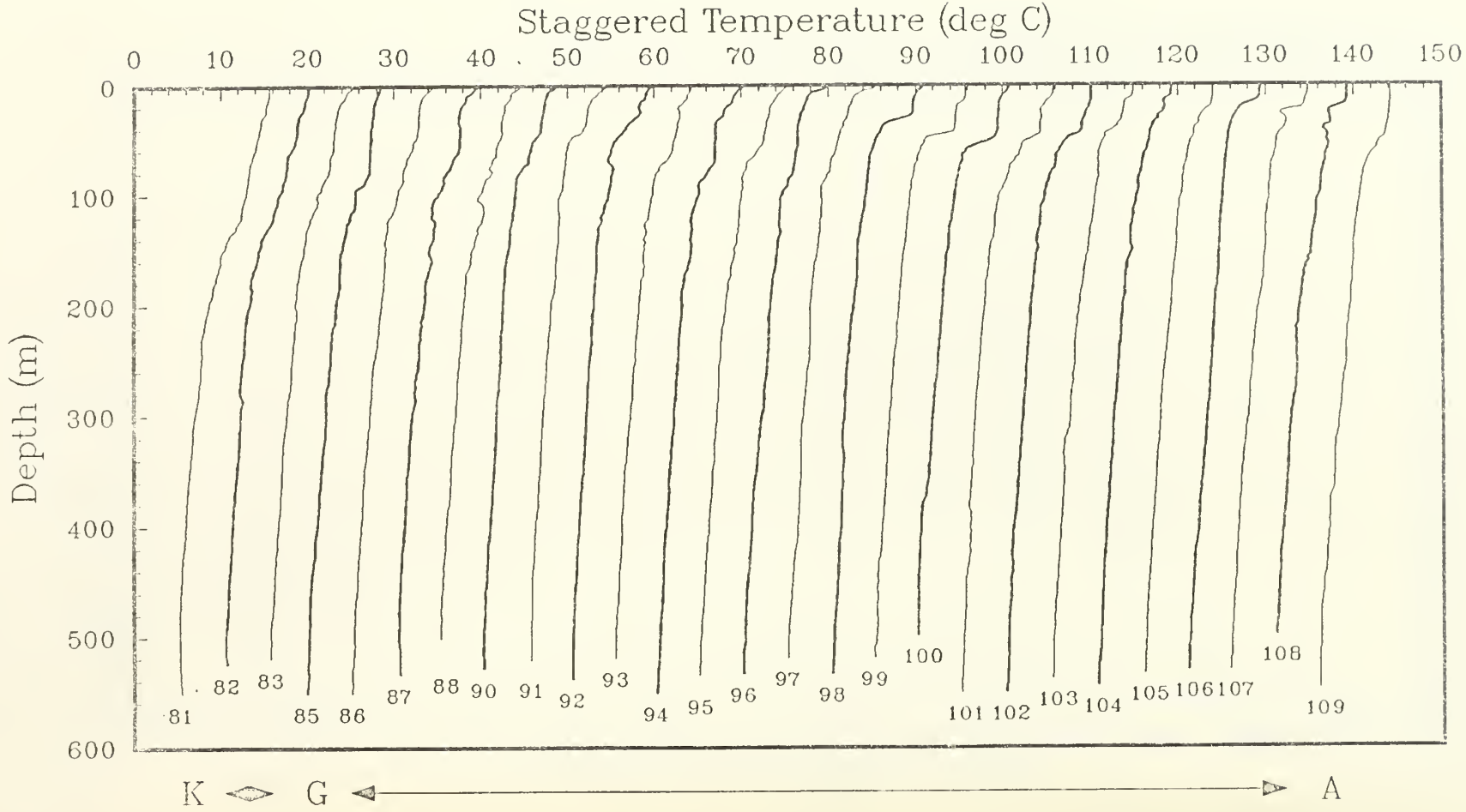

Staggered Temperature (deg C)
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Depth (m)
0 100 200 300 400 500 600
81 82 83 85 86 87 88 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
K G A

Figure 32(d)

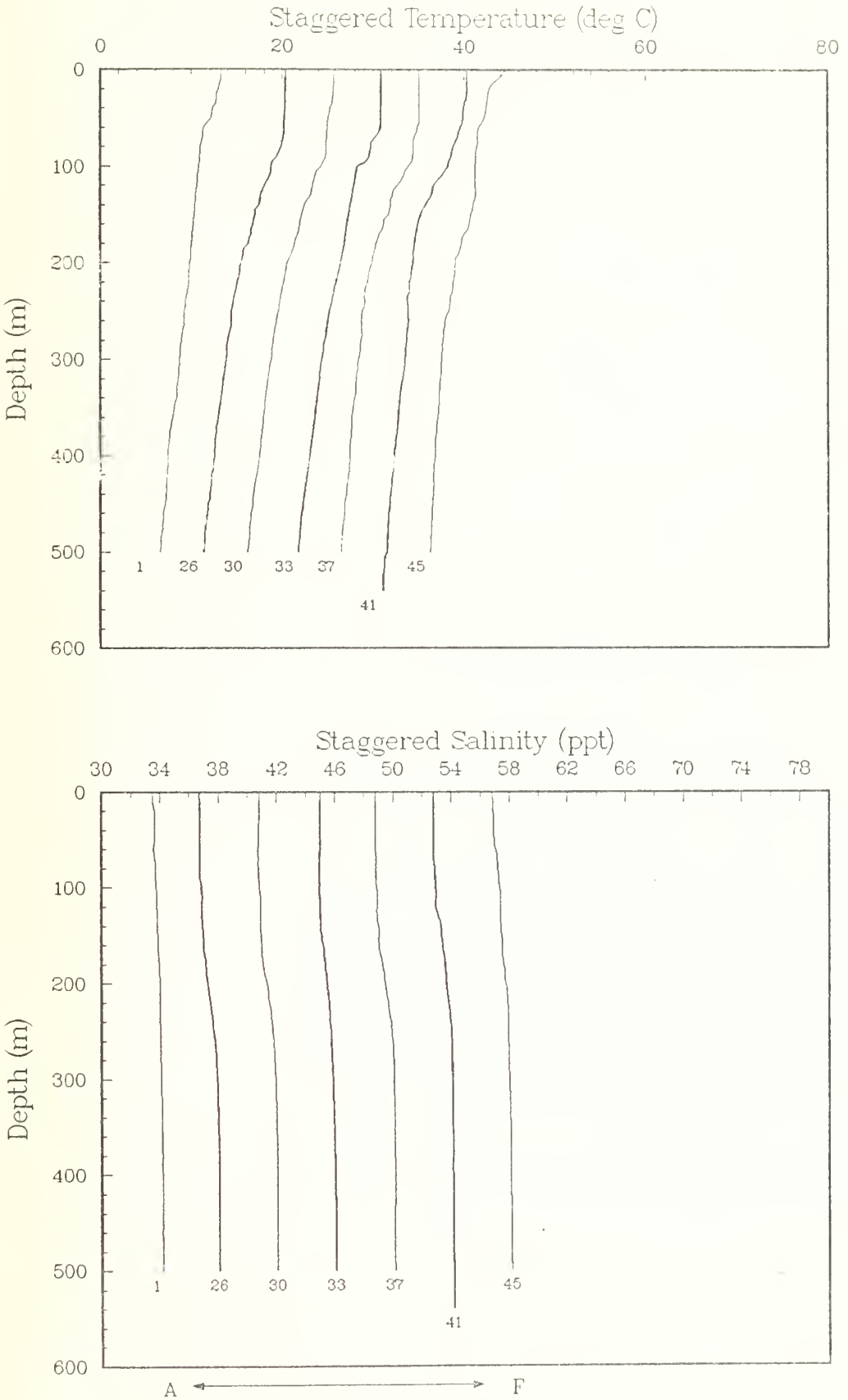
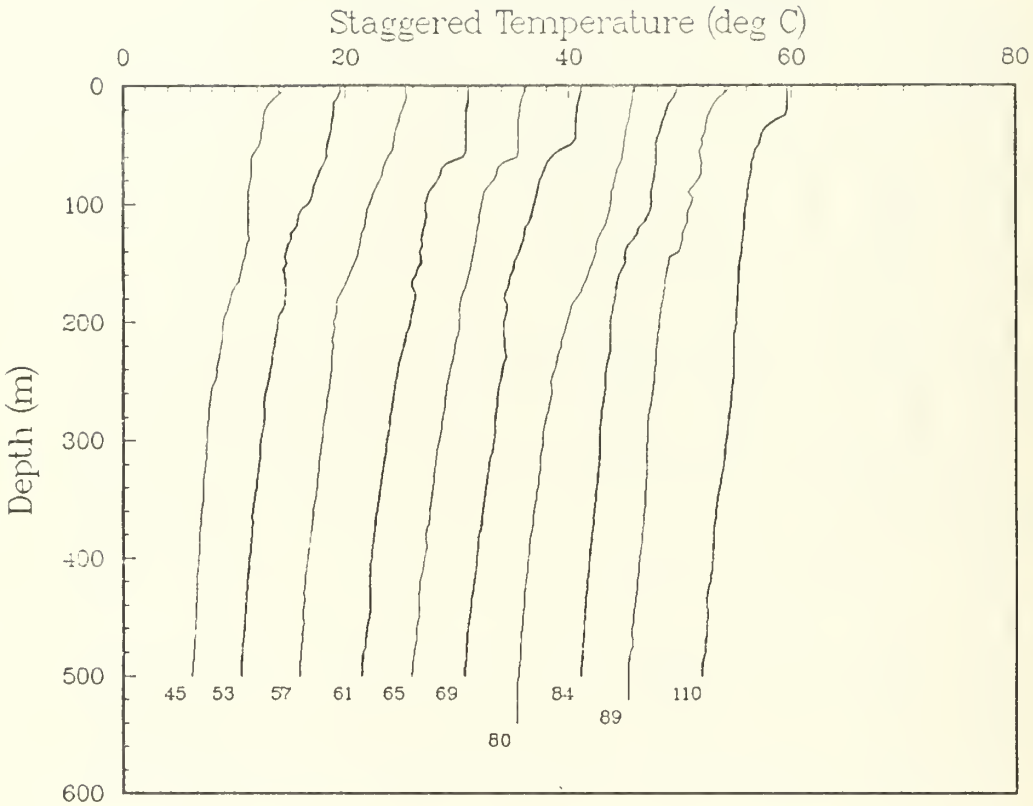


Figure 3(b): CTD temperature profiles, staggered by multiples of 2 deg C, and salinity profiles, staggered by multiples of 4 ppt. [illegible].


Staggered Temperature (deg C)
0
20
40
60
80
Depth (m)
0
100
200
300
400
500
600
45
53
57
61
65
69
80
84
89
110

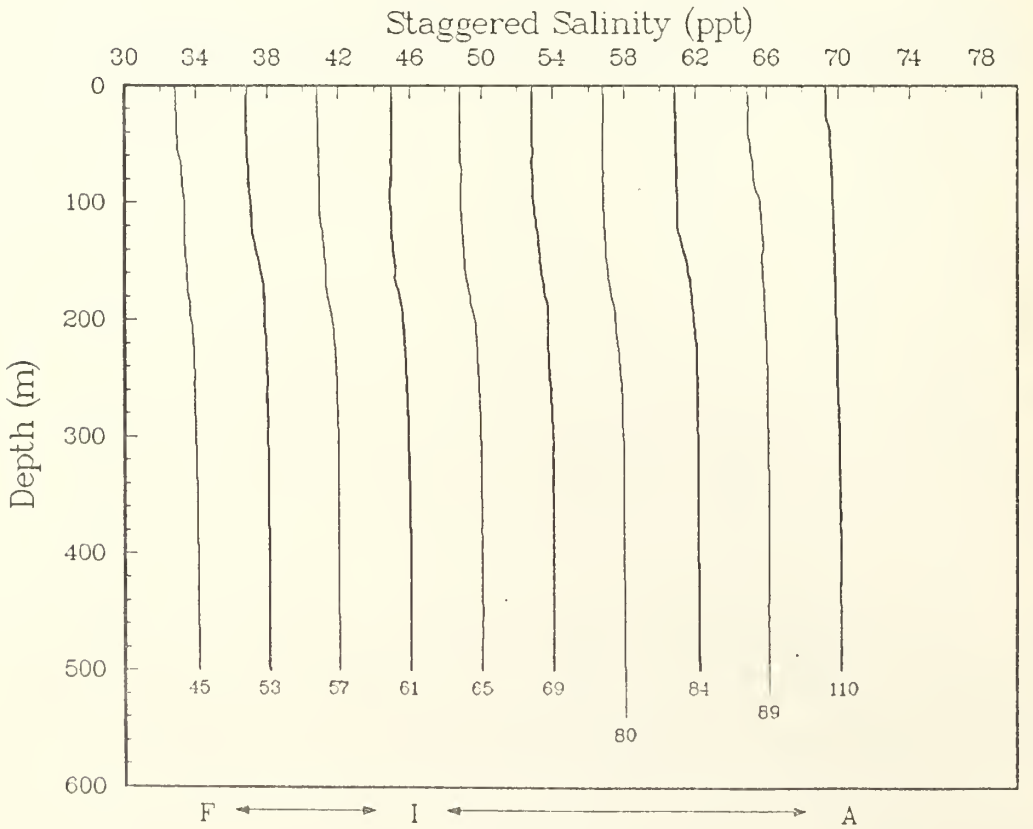

Staggered Salinity (ppt)
30
34
38
42
46
50
54
58
62
66
70
74
78
Depth (m)
0
100
200
300
400
500
600
45
53
57
61
65
69
80
84
89
110
F
I
A

Figure 33(b)

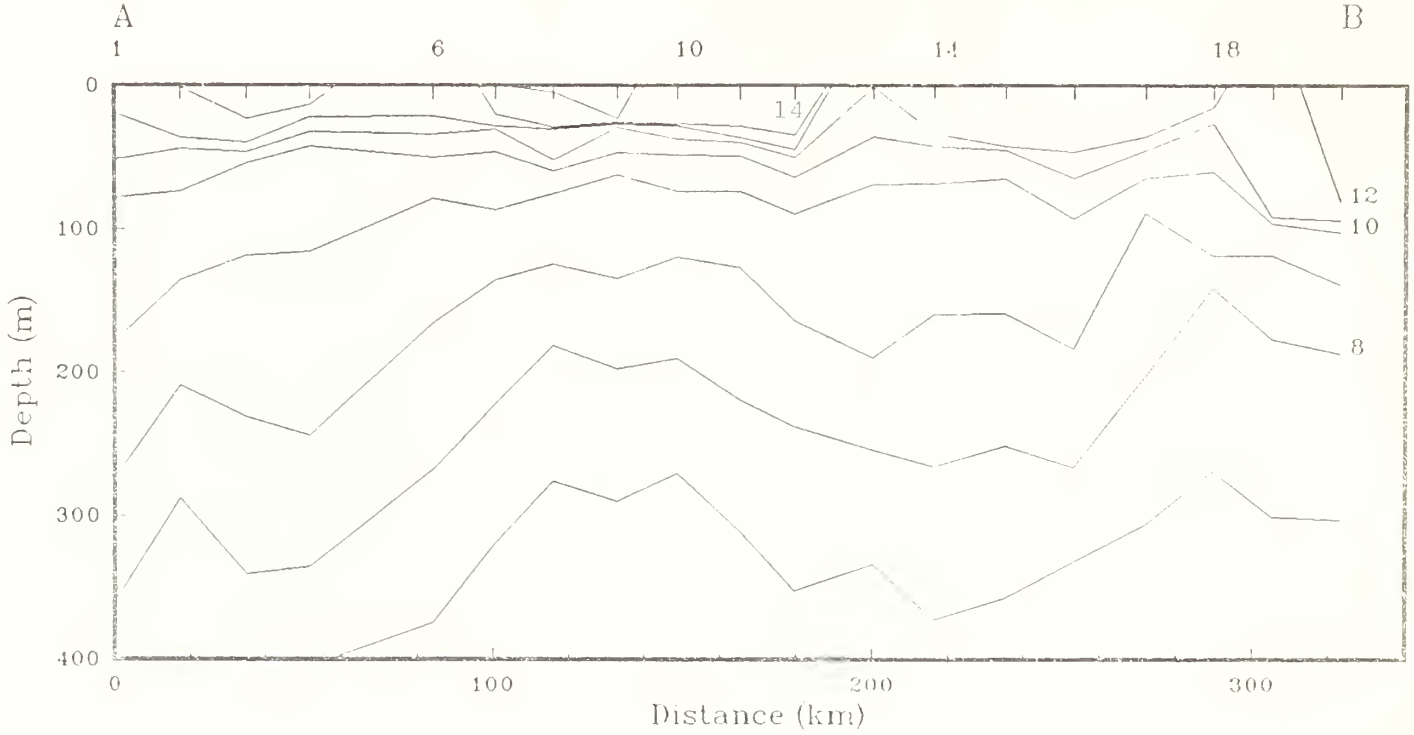


Figure 34(c): Isotherms from XBT's and CTD's. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. [illegible].

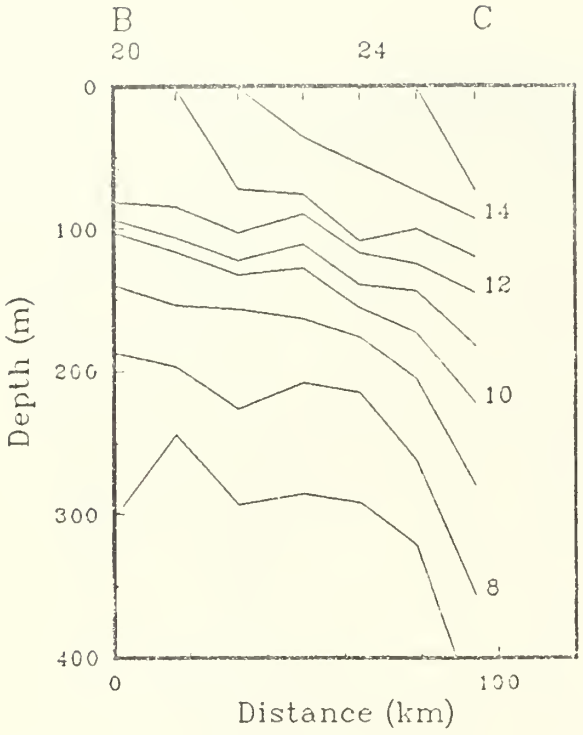


Figure 34(b)

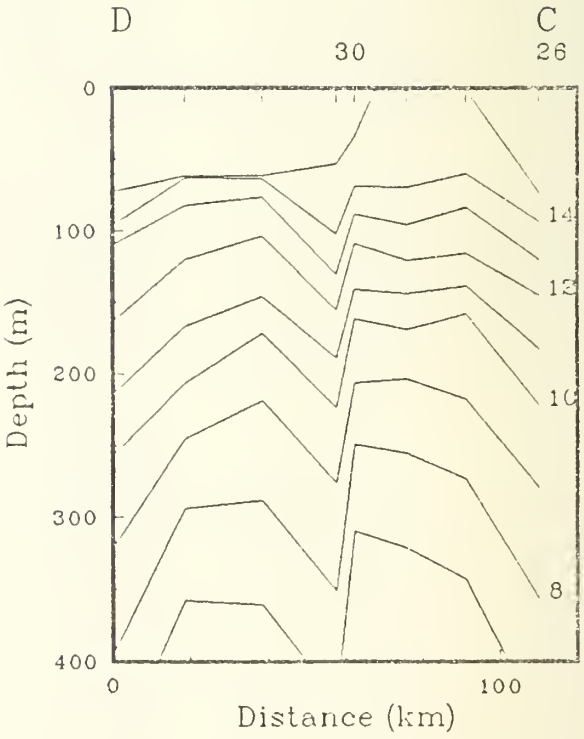


Figure 34(c)

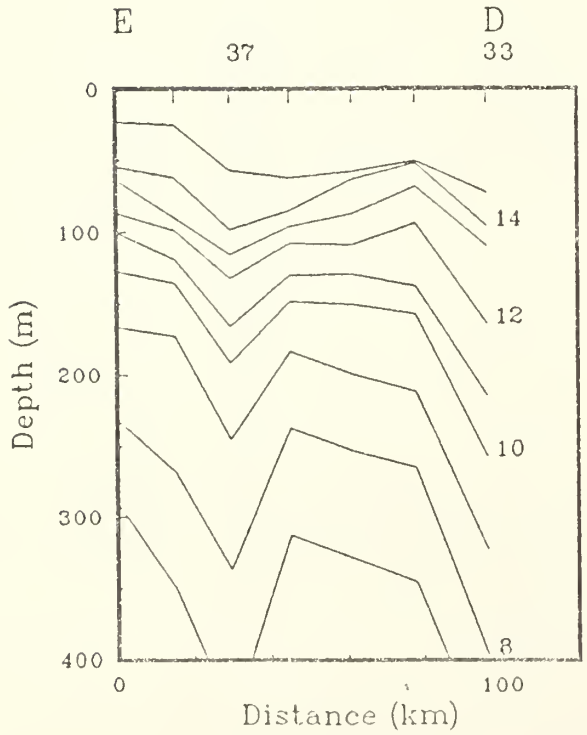


Figure 34(d)

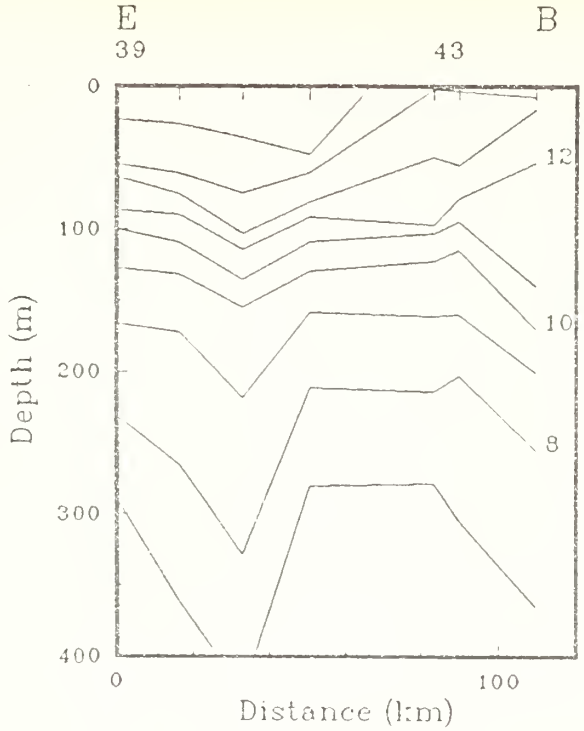


Figure 31(e)

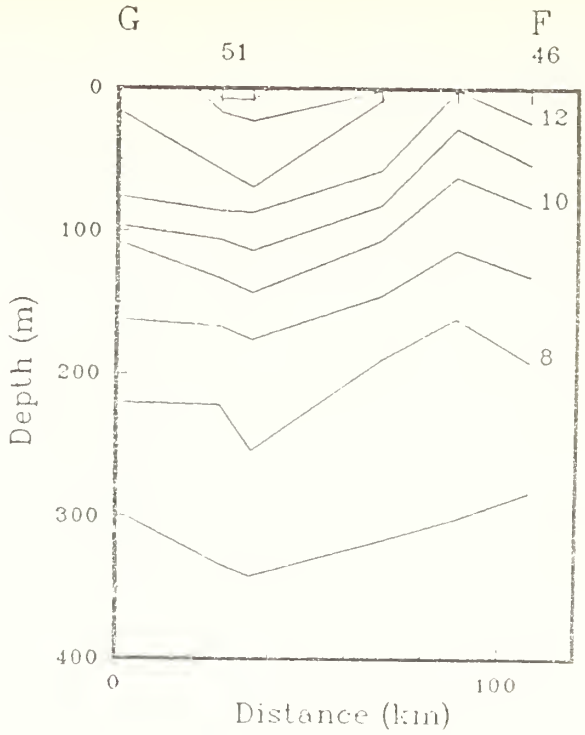


Figure 31(f)

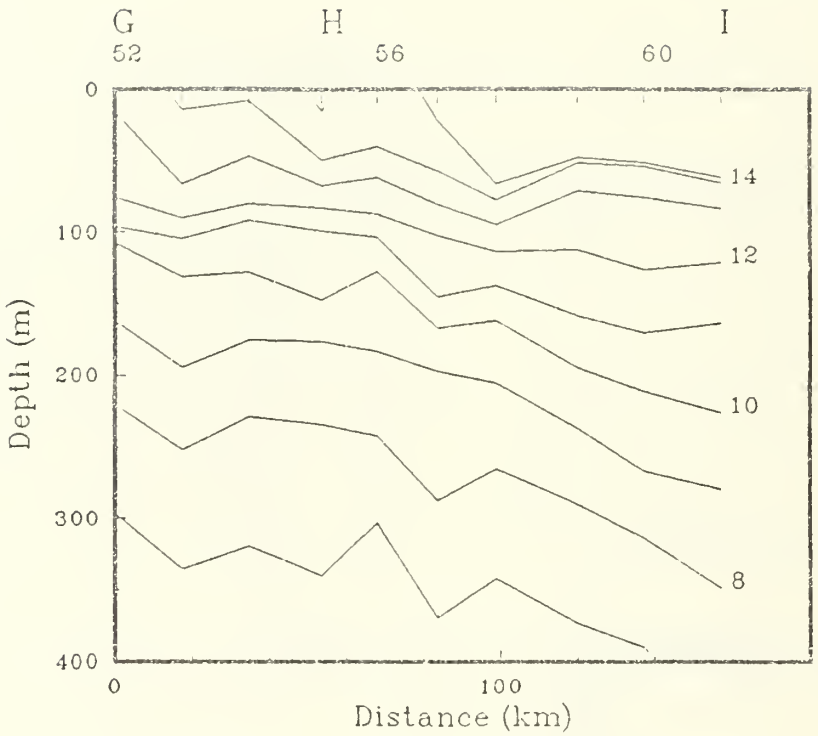


Figure 34(g)

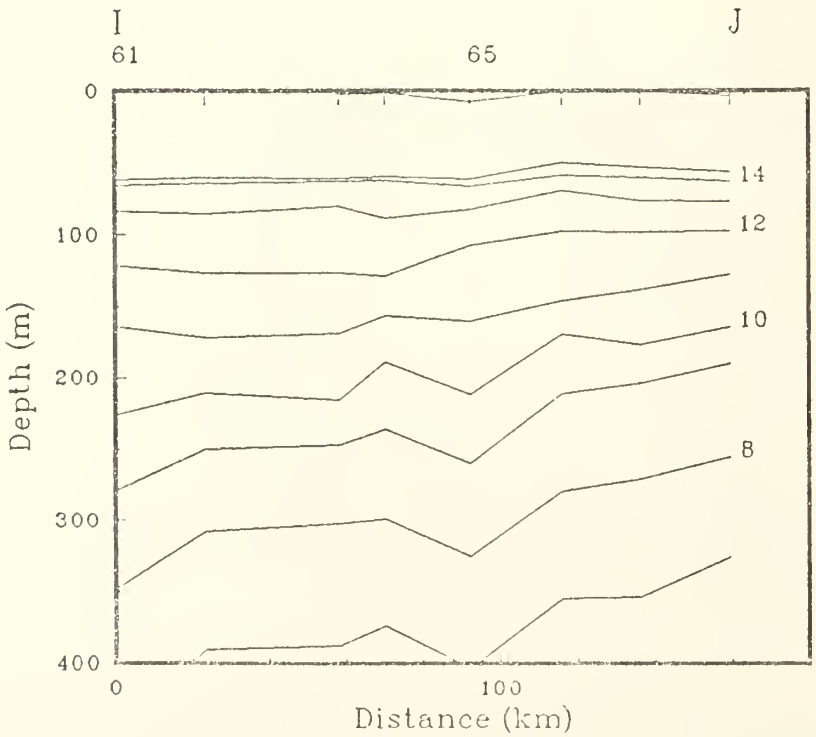


Figure 34(h)

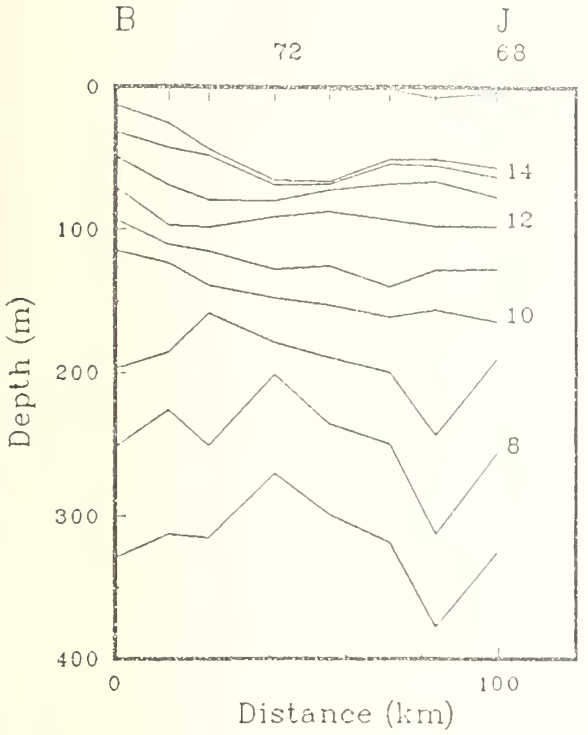


Figure 34(i)

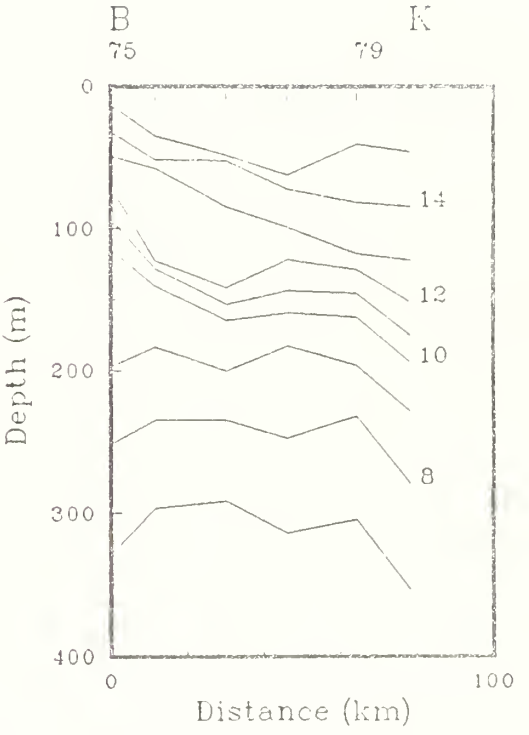


Figure 34(j)

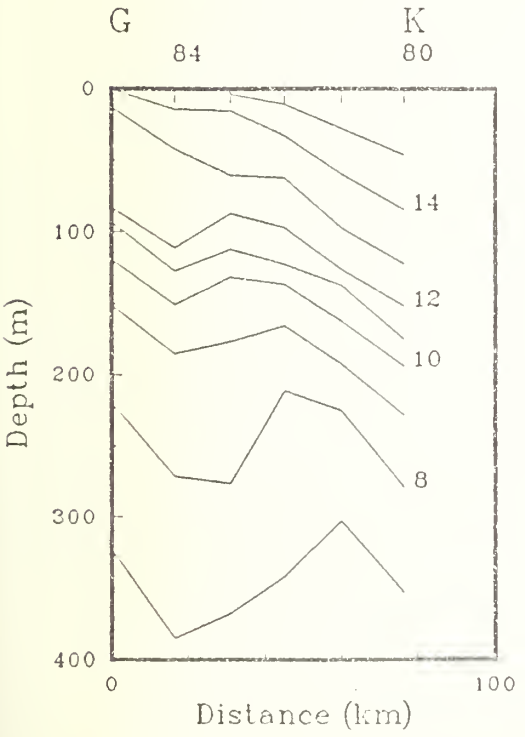


Figure 34(k)

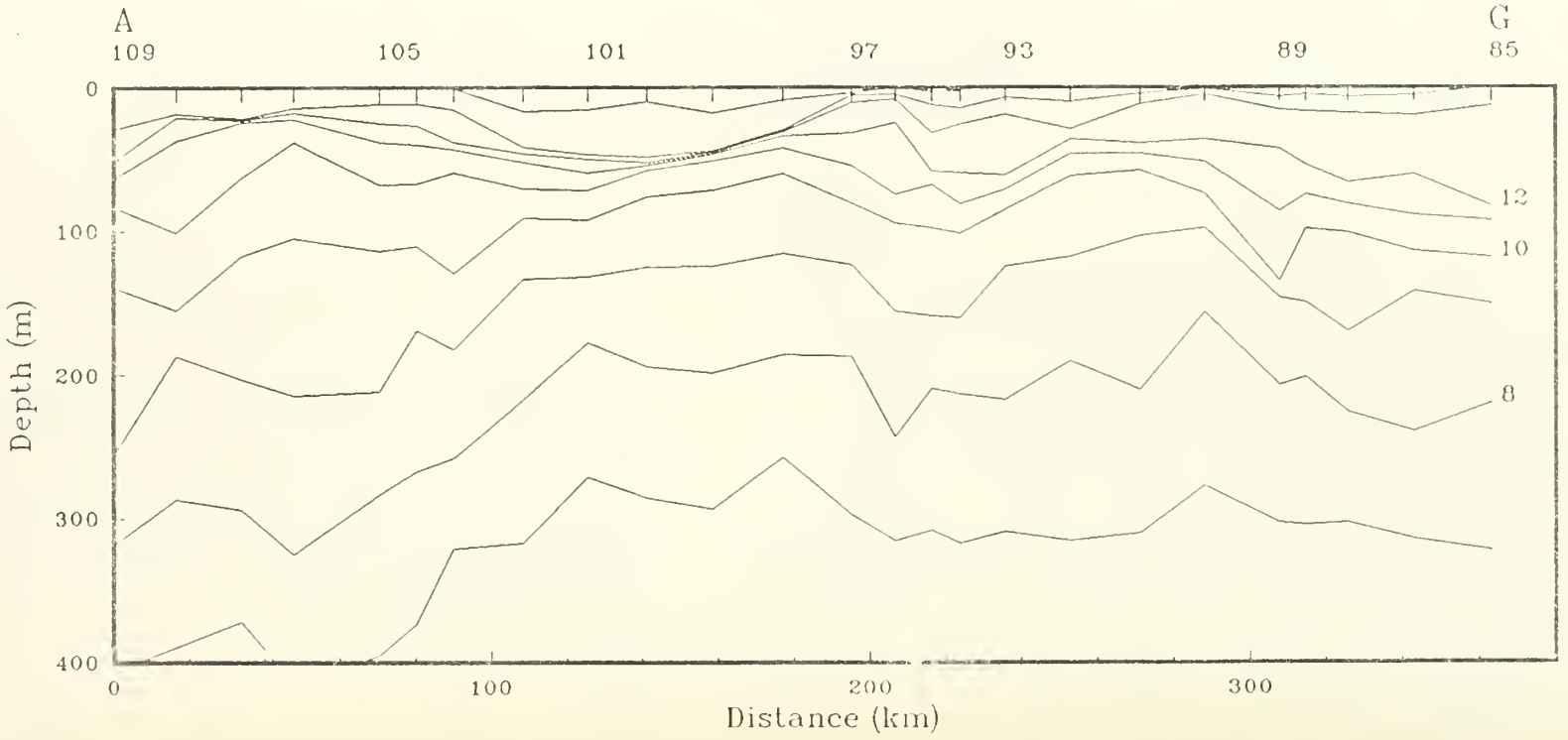
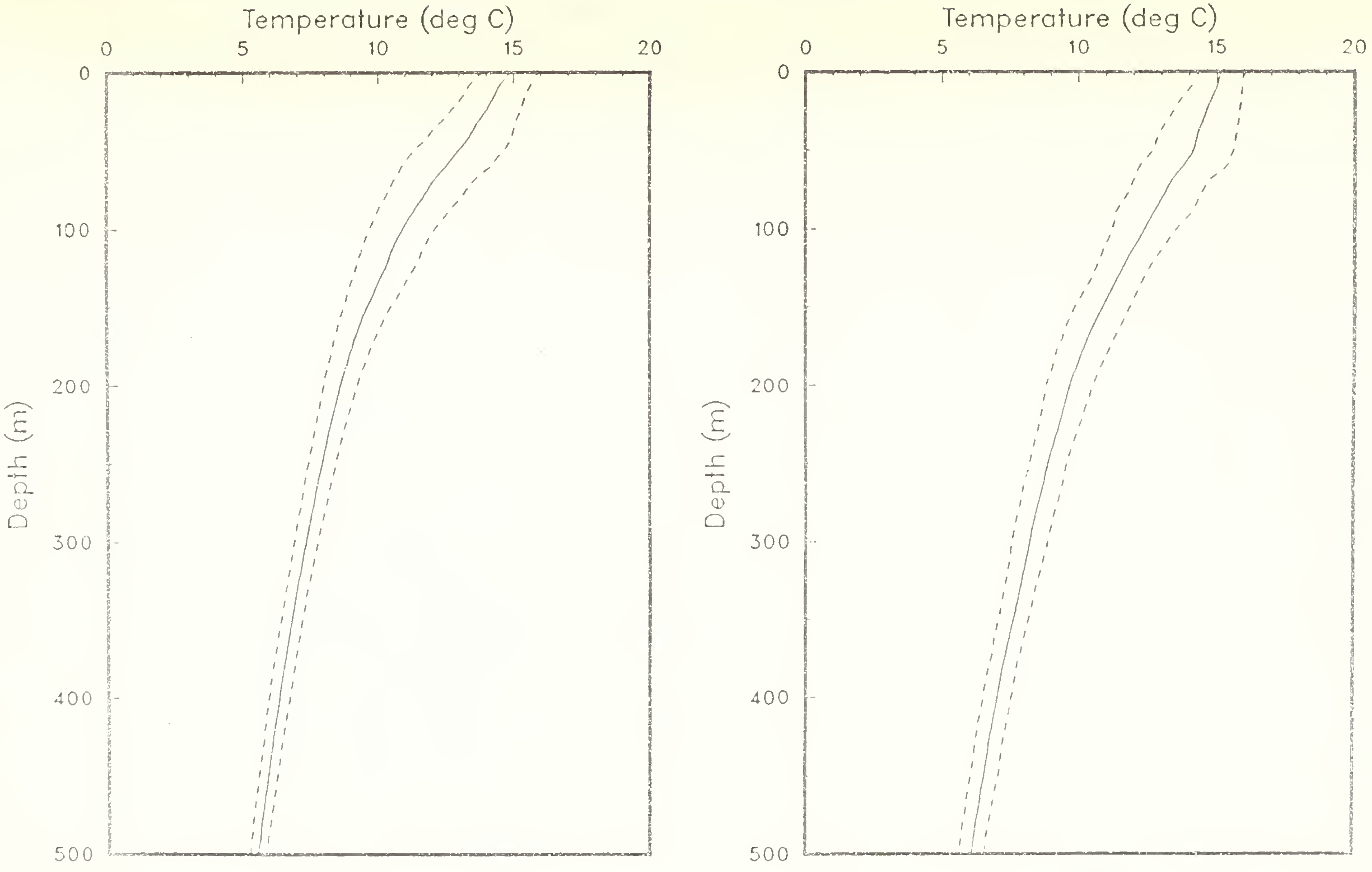

A
G
109
105
101
97
93
89
85
0
100
200
300
400
Depth (m)
12
10
8
0
100
200
300
Distance (km)

Figure 31(1)



(a) (b)

[illegible]: Profile of $\overline{T(z)}$ with + and - the standard deviation from [illegible]
[illegible]TOMAS, [illegible]).

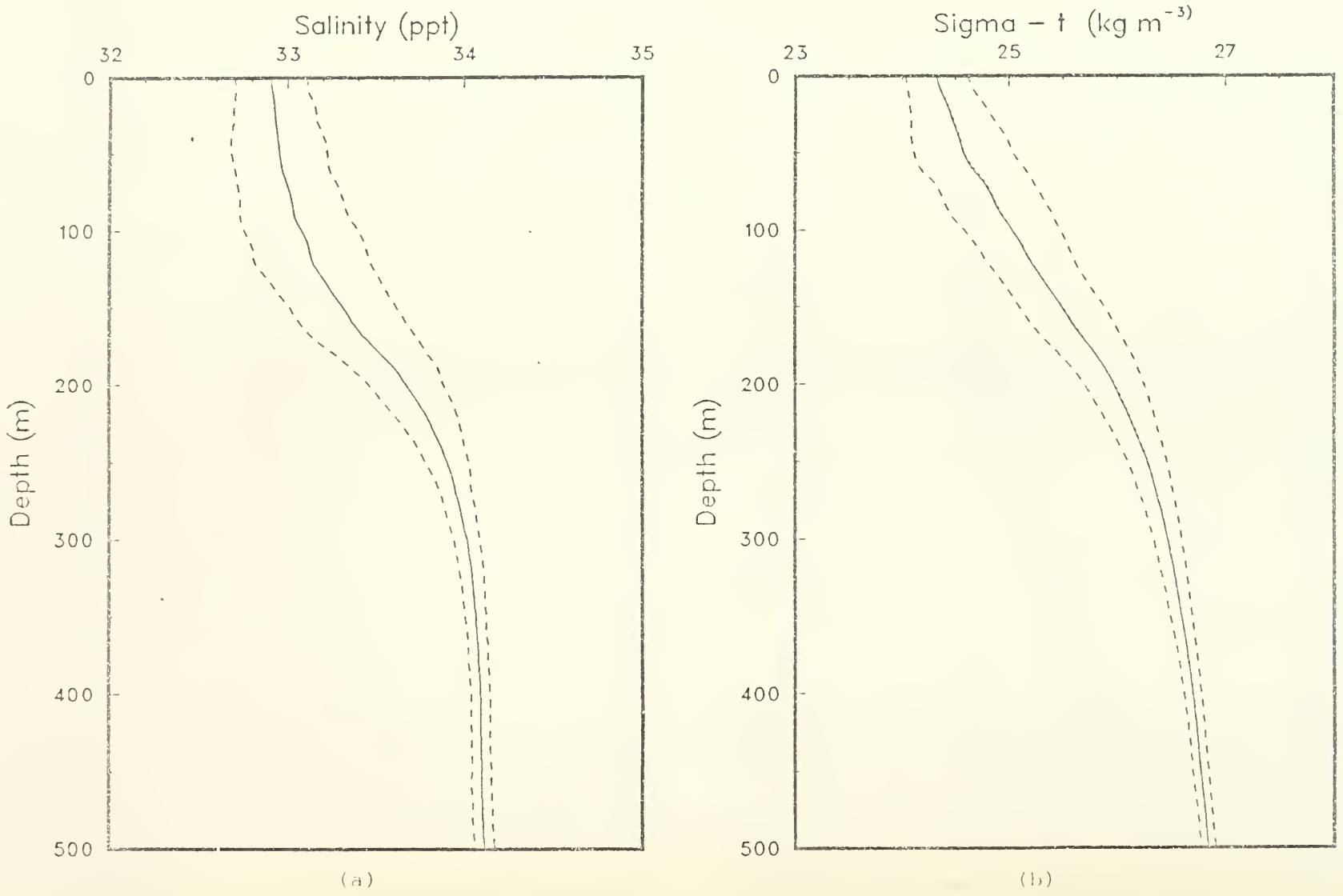


Figure 36: Profiles of (a) mean salinity and (b) mean sigma t, with 1 and the standard deviations, from the CTD's. (OPTOMA5, Leg AIII).

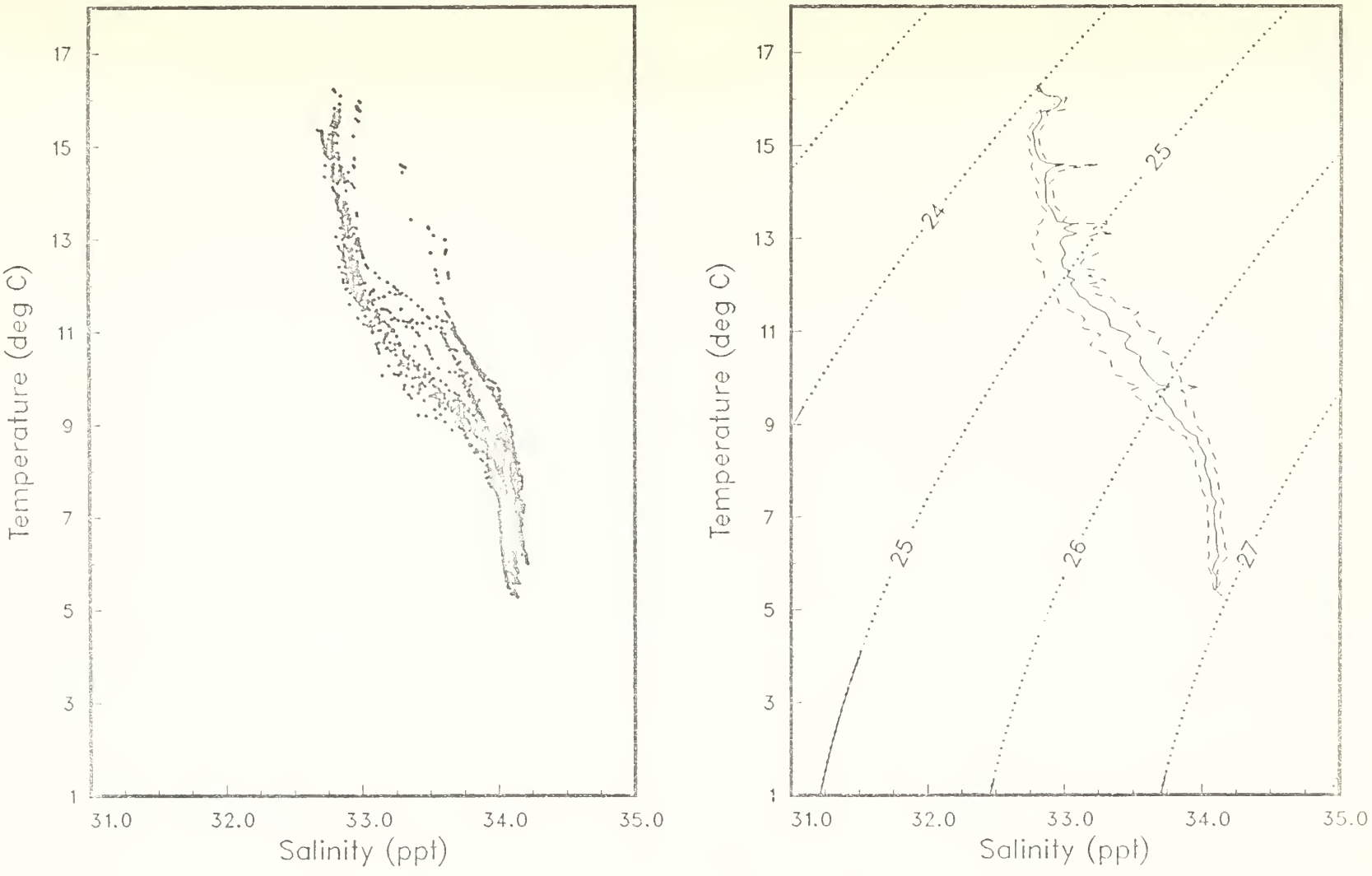


Figure 37: (a) T-S plots and (b) mean T-S relationship, with 1 and 2 the standard deviation, and selected sigma-t contours, from the CTD casts. (OPTOMA, Leg XIII).

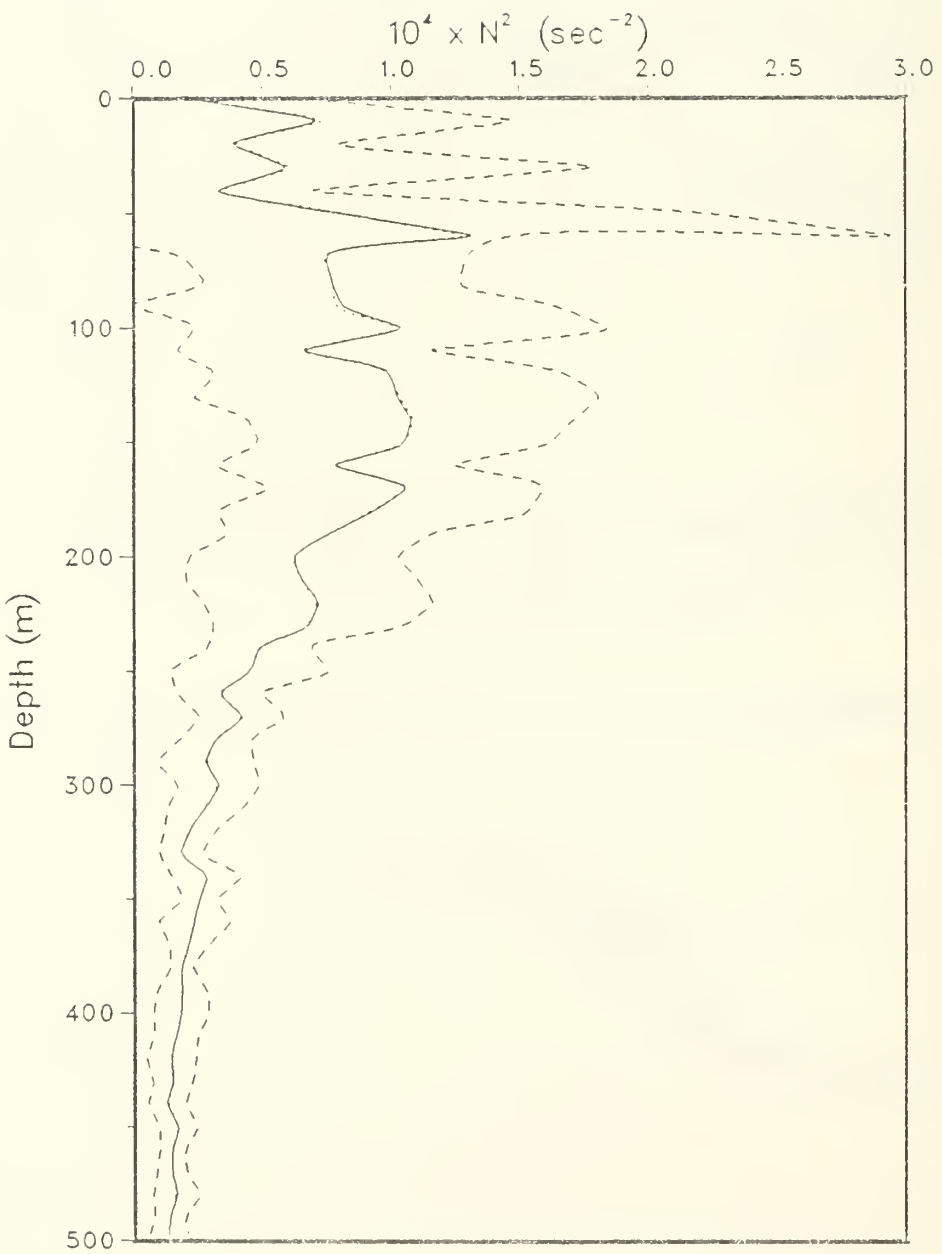


Figure 38: Profile of $\overline{N^2(z)}$ (———), with + and - the standard deviation (----), and the profile of N^2 from $\overline{T(z)}$ and $\overline{S(z)}$ (·····). (OPTOMA5, Leg AIII).

ACKNOWLEDGEMENTS

This research was sponsored by the ONR Physical Oceanography Progra . The success of the fieldwork was strongly dependent on the competent, willing support of the crew of the R/V ACANIA and USNS DE STREIGNER

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REFERENCE

Lewis, E.L. and R.G. Perkin, 1981: The Practical Salinity Scale 1978: conversion of existing data. Deep Sea Res. 28A, 307-328.

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